PB89-196687

Superfund Record of Decision (EPA Region 9): Operating Industries, Inc. (OII), Monterey Park, California (Third Remedial Action), September 1988

(U.S.) Environmental Protection Agency, Washington, DC

30 Sep 88

U.S. Department of Commerce
National Technical Information Service
NTIS

PB89-196687

United States
Environmental Protection
Agency

Office of
Emergency and
Remedial Response

EPA/ROD/R09-88/013
September 1988

EPA

Superfund Record of Decision:

Operating Industies, CA

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Third Remedial Action

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16. Abstract (Limit: 200 words)

The Operating Industries Inc. (OII) site is a 190-acre landfill located in Monterey Park, California, 10 miles east of Los Angeles. To the northwest and east of the site the land use is primarily industrial; residential units are located to the southwest, east and west of the site. There are approximately 53,000 residences within a 3-mile radius of the site. Available data indicate that 2,150 people live within 1,000 feet of the landfill. Disposal activities at the site began in October 1948 by the Monterey Park Disposal Company (MPDC) who used the site as a municipal landfill on behalf of the City of Monterey Park. In 1952, the site and additional land, totalling 218 acres, were purchased by OII. The landfill was permitted to accept household refuse, organic refuse, scrap metal, non-decomposable inert solids, and certain types of liquids. In 1964, the State of California purchased 28 acres of the land owned by OII to construct the Pomona Freeway, which divided the site into two sections. In 1975, Monterey Park City limited solid waste disposal to a 130-acre section of the landfill and a year later restricted disposal of liquids to a 32-acre section of the landfill. In April 1983, OII ceased accepting all liquid wastes; disposal of all solid wastes ended in October 1984. EPA currently is performing operation and maintenance of the existing leachate collection system, perimeter gas extraction system and interior gas extraction system. (See Attached Sheet)

17. Document Analysis a. Descriptors
Record of Decision
Operating Industries, CA
Third Remedial Action
Contaminated Media: air
Key Contaminants: VOCs (benzene, PCE, TCE, toluene)

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

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20. Security Class (This Page) None

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Department of Commerce

EPA/ROD/R09-88/013
erating Industries, CA
Third Remedial Action

16. ABSTRACT (continued)

This remedial action addresses only the issue of landfill gas (LFG) migration control and destruction. Final cover, leachate collection, ground water and soil contamination, slope stability and final closure will be addressed in subsequent remedial action. The primary contaminants of concern affecting the air are methane and VOCs including benzene, PCE, TCE and toluene.

The selected remedial action at the site includes: installation of perimeter LFG extraction wells, pile-driven wells on the top deck of the landfill, shallow and deep slope wells to control intermediate-to-deep subsurface migration at the perimeter, and integrated perimeter and interior LFG headers; utilization of existing gas extraction wells and gas monitoring probes; installation of multiple completion monitoring wells at the property boundary, landfill gas destruction facilities and an automated control station for the gas control system; and installation of abovegrade condensate sumps to collect condensate from gas headers, leachate pumps in gas wells to dewater saturated zones, and abovegrade leachate sumps. The selected remedial action for the North Parcel system includes: installation of 6 single completion extraction wells to the depth of the refuse and installation of 1,500 feet of header lines. The estimated present worth for this remedial action is $73,000,000 with an annual O&M cost of $2,340,000.

RECORD OF DECISION

TABLE OF CONTENTS

DECLARATION STATEMENT i

DECISION SUMMARY

- SCOPE AND ROLE OF OPERABLE UNIT 1
- SITE DESCRIPTION 2
- SITE HISTORY AND ENFORCEMENT ACTIVITIES 4
- COMMUNITY RELATIONS HISTORY 9
- SITE CHARACTERISTICS 9
- SUMMARY OF SITE RISKS 13
- DOCUMENTATION OF SIGNIFICANT CHANGES 16
- DESCRIPTION OF ALTERNATIVES 17
- SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES 21
- SELECTED REMEDY 24
- STATUTORY DETERMINATIONS 31

ATTACHMENTS

- RESPONSIVENESS SUMMARY
- ADMINISTRATIVE RECORD INDEX

DECLARATION

SITE NAME AND LOCATION

Operating Industries, Inc. (OII)
Monterey Park, California

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for Operating Industries, Inc. Site, in Monterey Park, California, developed in accordance with CERCLA, as amended by SARA, and to the extent practicable, the National Contingency Plan. This decision is based upon the administrative record for this operable unit at this site. The attached index identifies the items which comprise the administrative record upon which the selection of the remedial action is based.

The State of California concurs with the selected remedy.

DESCRIPTION OF THE REMEDY

This is the third operable unit for the OII site. As an operable unit this document addresses only the issue of landfill gas (LFG) migration control. The Gas Control Remedial Action will be integrated with the final site remedy as the component for collecting and destroying landfill gas which would otherwise be released from the site. Final cover, leachate collection, groundwater, slope stability, soil contamination, and final closure will be fully addressed in the final Remedial Investigation/Feasibility Study for the site, or in future Operable Units.

The major components of the selected landfill gas control remedy include:

- Installing 58 new perimeter LFG extraction wells, as shown in Figure 5, with placement focused on minimizing offsite LFG migration.
- Installing 48 pile driven wells on the top deck of the landfill with placement focused on maximizing source control of LFG.

DECISION SUMMARY

OPERATING INDUSTRIES, INC.

GAS MIGRATION CONTROL OPERABLE UNIT

RECORD OF DECISION

- Installing 50 shallow and 12 deep slope wells with placement focused on reducing surface emissions, and controlling intermediate to deep subsurface migration at the perimeter.
- Installing new integrated perimeter and interior LFG headers (abovegrade).
- Utilizing functional existing gas extraction wells and gas monitoring probes.
- Installing 58 multiple completion monitoring wells at the property boundary.
- Installing landfill gas destruction facilities with a capacity of approximately 9,000 cfm, and an automated control station for the gas control system.
- Installing abovegrade condensate sumps to collect condensate from gas headers.
- Installing leachate pumps in gas wells to de-water saturated zones, and installing abovegrade leachate sumps.

DECLARATION

The selected remedy is protective of human health and the environment, a waiver can be justified for whatever Federal and/or State applicable or relevant and appropriate requirements which will not be met, and it is cost-effective. This remedy satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility or volume as a principal element and utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable.

Because this remedy will result in hazardous substances remaining onsite above health-based levels, a review will be conducted within five years after commencement of the final remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

9·30·88
Date

Daniel W. McGovern
Daniel W. McGovern
Regional Administrator
EPA, Region IX

SCOPE AND ROLE OF OPERABLE UNIT

The Operable Unit Feasibility Study (OUFS) for Landfill Gas (LFG) Migration Control at the Operating Industries, Inc. (OII) Landfill in Monterey Park, California, has been conducted to evaluate potential remedial alternatives for mitigating the LFG problems at the site. The U.S. EPA is addressing LFG problems as an operable unit so that a gas migration control remedial action can be initiated prior to implementation of the overall final remedial action for the site. The Gas Control Remedial Action will be integrated with the final site remedy as the component for collecting and destroying landfill gas which would otherwise be released from the site.

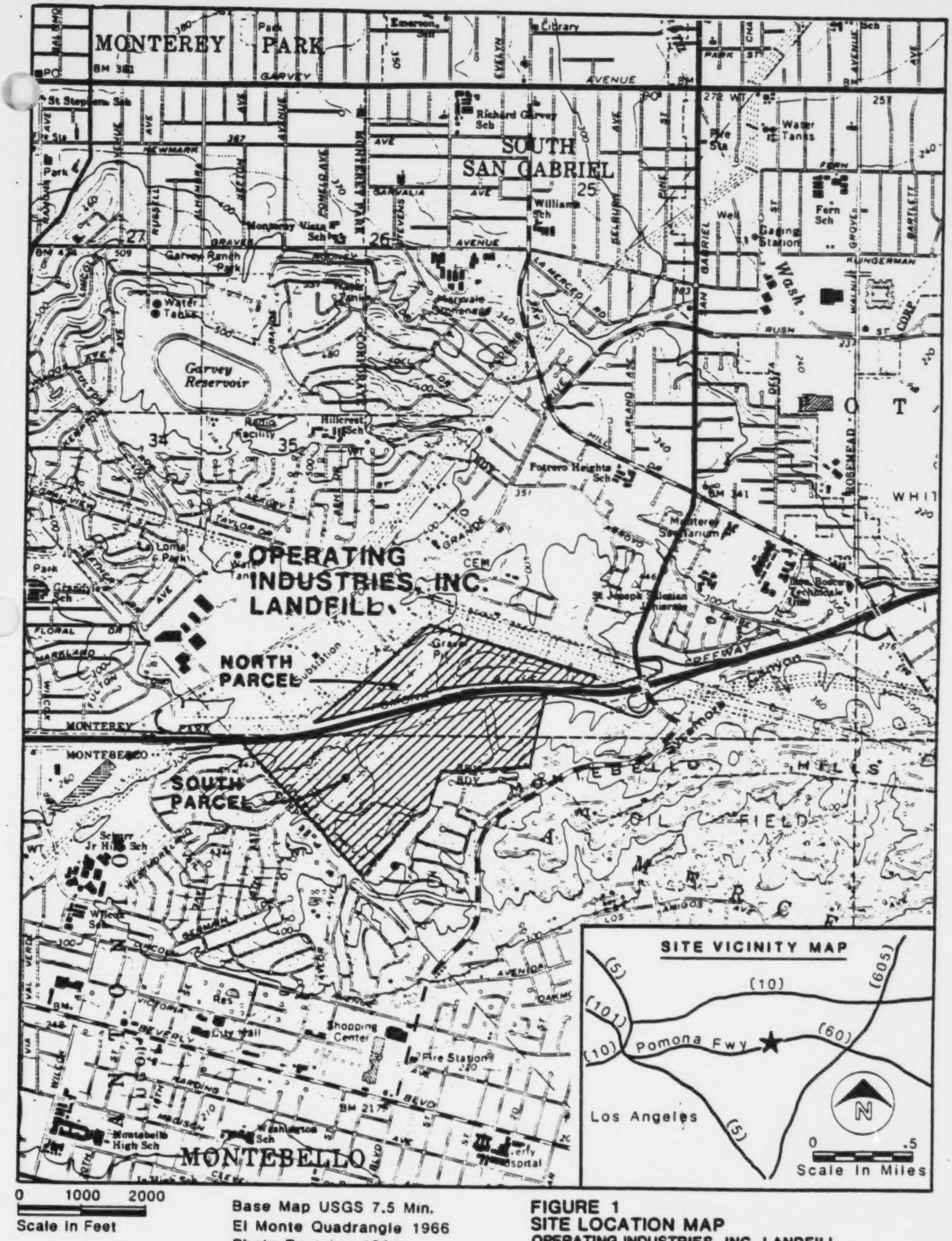
As an Operable Unit, this document addresses only the issue of LFG migration control. It does not address other issues such as leachate and condensate management, groundwater contamination, final site closure, and final remedy. This is the third operable unit for the OII site. A Record of Decision (ROD) for Site Control and Monitoring was signed on July 31, 1987, and a ROD for Leachate Management was signed on November 16, 1987. Final cover, leachate collection, groundwater, slope stability, soil contamination and final closure will be addressed in the final Remedial Investigation/Feasibility Study for the site, or in future Operable Units.

SITE DESCRIPTION

The OII Landfill is located at 900 Potrero Grande Drive, Monterey Park, 10 miles east of Los Angeles (Figure 1). The site is 190 acres in size with 145 acres (south parcel) lying south of the Pomona Freeway (California Highway 60) and 45 acres (north parcel) to the north. Ground surface elevations adjacent to the south parcel vary from approximately 500 feet above mean sea level (msl) along the south boundary to approximately 380 feet above msl along the Pomona Freeway. The top of the south parcel varies from 620 to 640 feet above msl. The north parcel is relatively level. The site is owned by Operating Industries, Inc., and related entities.

The adjacent land ownership is as follows:

- The Southern California Edison Company (SCE) owns the land abutting the north parcel, north of the Pomona Freeway. The SCE substation complex is located south of Potrero Grande Drive on the west side of Greenwood Avenue. A nursery leases the remaining SCE property.
- The land east of the south parcel, bounded by the Pomona Freeway, Montebello Boulevard, and Paramount Boulevard, is owned by Chevron U.S.A., Inc., and is currently undeveloped. It is currently used for oil recovery by Chevron.
- The Southern California Gas Company, a subsidiary of the Pacific Lighting Gas Supply Company, operates an underground gas storage facility in the area adjacent to the west boundary of the landfill.
- A piece of property to the south is jointly owned by Continental Development of California, Inc., and California Bankers Trust Company.
- The remaining land adjacent to the landfill is primarily residential with single-family homes to the south and southwest of the landfill boundary. The City of Montebello's Iguala Park also borders the southern boundary of the landfill.


MONTEREY PARK
SOUTH SAN GABRIEL
Garvey Reservoir
Garvey Ranch Park
Richard Garvey Sch
Monterey Vista Sch
Hillcrest Sch
Potrero Heights Sch
Fern Sch
Water Tanks
Radio Facility
La Loma Park
St Joseph Salesian Juniorate
Don Bosco Technical
OPERATING INDUSTRIES, INC. LANDFILL
NORTH PARCEL
SOUTH PARCEL
Substation
MONTEBELLO HILLS
MONTEBELLO OIL FIELD
Schurr Jr High Sch
Wilcox Sch
Shopping Center
City Hall
Fire Station
Montebello High Sch
Washington Sch
MONTEBELLO
Beverly Hospital
FREEWAY
GARVEY AVENUE
SITE VICINITY MAP
(5)
(10)
(605)
(101)
(10)
(60)
Pomona Fwy
Los Angeles
(5)
N
0
.5
Scale In Miles
0
1000
2000
Scale In Feet

Base Map USGS 7.5 Min.
El Monte Quadrangle 1966
Photo Revision 1981

FIGURE 1
SITE LOCATION MAP
OPERATING INDUSTRIES, INC. LANDFILL
OUFS-GAS MIGRATION CONTROL

LAND USE AND DEMOGRAPHY

The City of Monterey Park zoning ordinance designation for the OII Landfill is M, Manufacturing. In Monterey Park, land to the northwest of the landfill is zoned C-4 (Arterial Service Commercial), C-M (Heavy Commercial-Nonmanufacturing). To the south and west of the landfill, land use primarily consists of residential units (single-family houses). Land to the east is zoned R-A-O, Residential, Agricultural, Oil Production District. A cemetery lies to the northeast along Potrero Grande Drive, and the remainder of this area, between Neil Armstrong Street and Paramount Boulevard, is zoned residential.

The City of Monterey Park has a population of 54,338 and the City of Montebello has a population of 52,929 (1980 Census). Within a three-mile radius of the site there are approximately 53,000 residences.

Regional Hydrogeology

OII is located in the La Merced Hills, between two major groundwater basins: the San Gabriel Basin to the north and east, and the Los Angeles Central Basin to the south.

The San Gabriel Basin aquifer system to the north includes both semiconsolidated and unconsolidated nonmarine sedimentary deposits of Pleistocene and Holocene age. The pattern of groundwater movement within this basin is generally from the perimeter mountains toward the Whittier Narrows. Subsurface outflow and surface flow in the Rio Hondo and San Gabriel Rivers through the Whittier Narrows provide a major source of recharge to the Los Angeles Central Basin, from the San Gabriel Basin to the north.

Los Angeles Central Basin aquifers consist of consolidated to unconsolidated marine and nonmarine rocks ranging from late Pliocene to Holocene age. Regional flow is generally to the west.

The depth and character of the water-bearing strata adjacent to and beneath the OII site are not well understood. Water level measurements from existing wells suggest that perched, unconfined, and confined zones may be present, but have not been adequately identified or characterized. Additional wells will be installed to define hydraulic gradients and to identify potential contaminant migration pathways as part of EPA's ongoing RI/FS at the site.

SURFACE-WATER HYDROLOGY

The major surface streams that receive run-off from the Montebello Hills are the Rio Hondo and Los Angeles Rivers. Tributaries to these drainages in the area of the OII Landfill contain only ephemeral flow generated by storm or urban run-off. The majority of natural drainages have been extensively modified and channelized or diverted to storm sewers.

SITE HISTORY AND ENFORCEMENT ACTIVITIES

Disposal operations at the OII Landfill site began in October 1948, when the Monterey Park Disposal Company (MPD) leased 14 acres from Henry H. Wheeler. An operations agreement between the City of Monterey Park and MPD provided that MPD would operate a municipal landfill on behalf of the City.

The landfill reverted to private ownership by the OII corporation in early 1952 when zoning variances for operating the landfill were not obtained by MPD. The site expanded to 218 acres as additional Wheeler property was obtained in 1953 and 1958.

The landfill was classified as Class II-I by the Los Angeles Regional Water Quality Control Board (LARWQCB) in October 1954. It was permitted to accept Group 2 wastes (ordinary household refuse, decomposable organic refuse, and selected scrap metal), Group 3 wastes (nondecomposable inert solids), and certain types of liquids.

The State of California (CALTRANS) purchased 28 acres from OII for the construction of the Pomona Freeway (completed in 1964), which separated the site into the 45-acre north parcel and the 145-acre south parcel. In August 1975, the Monterey Park City Council adopted Resolution 78-76, which eliminated solid waste disposal on the north parcel and on a 15-acre area in the northwestern section of the south parcel. Thus, after 1975, solid waste disposal was limited to a 130-acre section of the south parcel.

The height of the landfill was first limited to 540 feet in 1957 based on the height of the surrounding hills. The City of Monterey Park increased the height limit to 605 feet in June 1975, and to 640 feet in August 1975.

In March 1976, the LARWQCB restricted disposal of liquids to a 32-acre area in the western portion of the south parcel. OII was allowed to mix liquids with solid refuse at a ratio of 10 gallons per cubic yard; the ratio was increased to 20 gallons per cubic yard in September 1976. Leachate generated at the site was collected and redisposed.

OII ceased accepting hazardous liquid waste in January 1983 and all liquid waste in April 1983. The California Department of Health Services (DOHS) classified leachate generated at the site as hazardous and prohibited redisposal, effective October 1984. OII stopped accepting all solid waste in October 1984.

Facilities have been constructed on the landfill to monitor and provide limited control of the offsite migration of landfill gas (LFG) and leachate from the landfill. A commercial gas recovery facility, referred to as the interior gas extraction system, was constructed by GSF Energy, Inc., in the interior area of the landfill. These systems are described in the following sections.

Landfill Gas Monitoring Probes

Sixteen LFG monitoring probes were installed by OII onsite along the west, south, and east borders of the south parcel of the landfill in 1976. In December 1981, 15 probes were added and the total 31 probes allowed LFG monitoring along the entire perimeter of the south parcel. In addition, 15 LFG monitoring probes were installed in the north parcel. Thirty-five perimeter probes were installed in July and August 1981 along the west and southwest boundaries to monitor the effectiveness of the air dike system.

Perimeter Gas Extraction System

The perimeter gas extraction system was installed by OII in five major phases on the south parcel to partially control offsite migration of LFG. Phase I (the air dike injection system), installed in 1981, consists of approximately 31 wells on the west border. This air dike injection system introduces air under pressure into the ground at the landfill perimeter to induce a positive pressure gradient and air flow as a barrier to LFG migration away from the landfill. Phases II/III/IV of the system, consisting of LFG extraction wells along the southern and eastern borders, were installed in 1982, and 1983.

After the wells were installed, gas was collected using a portable blower and flare system. In 1983, a permanent blower and flare station (now known as the auxiliary flare) was installed in the southwest corner of the landfill, and the wells were connected with a header system. By July 1983, both the auxiliary flare and portable system were in operation. Phase V wells were connected in May 1984.

The rim well system on the southeast slopes was also added in 1984. This system collects landfill gas from an upper bench of the landfill near the southern perimeter. The wells are relatively shallow, and extract LFG from the above-ground portion of the landfill. The rim wells are connected to the perimeter gas extraction system and, therefore, operate independently of the nearby interior gas extraction system. A new flare station (now known as the main flare) in the northwest corner of the landfill was added in 1984.

Leachate Collection System

The leachate collection system is described in the EPA Leachate Management ROD of November 16, 1987, and is not described further here. Liquids collected from the gas extraction system will be managed under the Leachate Management Remedial Action, or subsequent Leachate Management provision of the final remedy for the site.

Interior Gas Extraction System

GSF (then called NRG NuFuels, Inc.) signed a contract with OII in August 1974 to develop a LFG recovery system for commercial purposes at the OII Landfill site.

The GSF gas collection system and plant began recovering methane for sale to Southern California Gas Company in October 1979. After deciding that continued resource recovery operations at OII were no longer economically viable, GSF relinquished ownership of all subsurface facilities to OII per their contract and notified the EPA that they intended to dismantle their aboveground facilities by March 1, 1987.

In April 1987, GSF, the EPA, and the South Coast Air Quality Management District (SCAQMD) completed negotiations for the purchase of GSF surface facilities using OII trust fund monies held by the SCAQMD. Extraction and flaring of LFG continued from February to May 1987 under temporary agreement between GSF, the SCAQMD, and the EPA. At present, LFG extraction and flaring are operated by the EPA.

EPA is currently performing operation and maintenance of the existing leachate collection system, the existing perimeter gas extraction system, and the existing interior gas extraction system. The system operation and maintenance includes daily monitoring of LFG probes (onsite and offsite, including water meter boxes), conducting scheduled maintenance of blower/flare stations and compressor equipment, and maintaining site security. This is described in the EPA Site Control and Monitoring ROD of July 31, 1987.

In addition, the EPA is conducting a remedial investigation/ feasibility study (RI/FS) to determine the nature and extent of contamination resulting from the site and to assess potential remedial actions.

Enforcement

Various state and local agencies have recorded that Operating Industries frequently violated waste disposal regulations during the operating life of the landfill from 1952 to 1984. Site inspections identified some of these violations and agencies notified Operating Industries to correct the noted problems.

Recent State and Local enforcement actions include:

1978 - Order for Abatement 2121 (South Coast Air Quality Management District) - The Order includes site maintenance, grading, soil cover, and waste disposal. The order has been modified six times. In 1983, installation of a gas emissions control system and a permanent leachate control system were added. OII has not complied with the major requirements of the order.

1980 - (California Waste Management Board) - Listed site on the California Open Dump Inventory due to RCRA subtitle D violations.

1981 - Cease and Desist Order (L.A. County DOHS) - Issued to OII for operating the landfill without an approved plan for control of landfill gas.

1982 - (City of Montebello) - Filed suit for permanent closure of the landfill to abate a continuing public nuisance.

1983 - Notice and Order (L.A. County DOHS) - Cited violations of California Administrative Code.

Supplemental Notice and Order (L.A. County DOHS) - Reiterates Order requirements, requires installation of gas probes, wells, daily monitoring of gas systems, reporting to L.A. County DOHS, CWMB, and SCAQMD.

1984 - Temporary Restraining Order 0500141 (CA DOHS) - Order to secure financial resources from OII for closure.

30-Day Preliminary Injunction (CA DOHS) - Addressed activities required for closure.

Remedial Action Order LA001 (CA DOHS) - Required leachate management, site characterization, landfill gas control, and closure plans.

Notice of Violation to OII (CA DOHS) - Notification of noncompliance with Remedial Action Order.

Clean-up and Abatement Order 84-5 (Regional Water Quality Control Board) - Reiterates requirements of CA DOHS Order, required phase-out of leachate redisposal, and construction/operation of a permanent leachate control system.

Clean-up and Abatement Order 84-119 (RWQCB) - Required interception, pumping and legal disposal of leachate, and prohibited discharge of leachate on and off-site.

EPA enforcement activities include:

1982 - Section 3008 Notice - Notice of EPA Interim Status Part 265 RCRA violations at OII.

1983 - RCRA Complaint Issued.

OII submitted draft closure documents in lieu of Part B.

RCRA Consent Agreement Signed

1984 - 3007/104 letters issued to OII and GSF.

OII proposed for the National Priorities List

RCRA Section 3007/CERCLA Section 104 Notice Letters/Information Requests issued to Operating Industries, Inc, and individual owners. (8/23/84)

1986 - OII finalized on NPL

General Notice Letters/3007/104 Information Requests sent to 27 Potentially Responsible Parties representing 50 percent of manifested wastes. (6/20/86)

Follow-up 3007/104 Letter sent to OII owners.

1987 - General Notice Letters/3007/104 Information Requests sent to 56 additional PRPs representing an additional 20 percent of manifested wastes. (1/9/87)

Follow-up 3007/104 Letter sent to OII owners.

Negotiations for PRP conduct of RI3/FS held, settlement not reached.

General Notice Letters/3007/104 Information Requests sent to 106 additional PRPs representing an additional 10 percent of manifested wastes. (11/4/87)

1988 - Joint Special Notice and Demand Letter issued to all noticed PRPs, including OII owners for past costs, design and construction of the Leachate Management Remedial Action, and Site Control and Monitoring Activities and EPA's associated oversight costs (2/18/88). Negotiations in progress.

Special Notice Letter/3007/104 Information Request sent to City of Monterey Park. (2/18/88)

COMMUNITY RELATIONS HISTORY

A history of community relations activities at the OII site, the background on community involvement and concerns, and specific comments on the Feasibility Study and EPA's responses are found in the Responsiveness Summary which accompanies this ROD.

SITE CHARACTERISTICS

Figure 2 illustrates the mechanisms at work in generation, emission, and subsurface migration of gases at the OII Landfill. The four major mechanisms of gas migration at OII are:

- Generation by anaerobic decomposition of the refuse within the landfill combined with volatile organic compounds released by hazardous substances disposed of at the landfill

- Surface emissions by releases and diffusion to the atmosphere through the top and sides of the landfill as well as from other areas where gas has migrated in the subsurface to the surrounding neighborhood

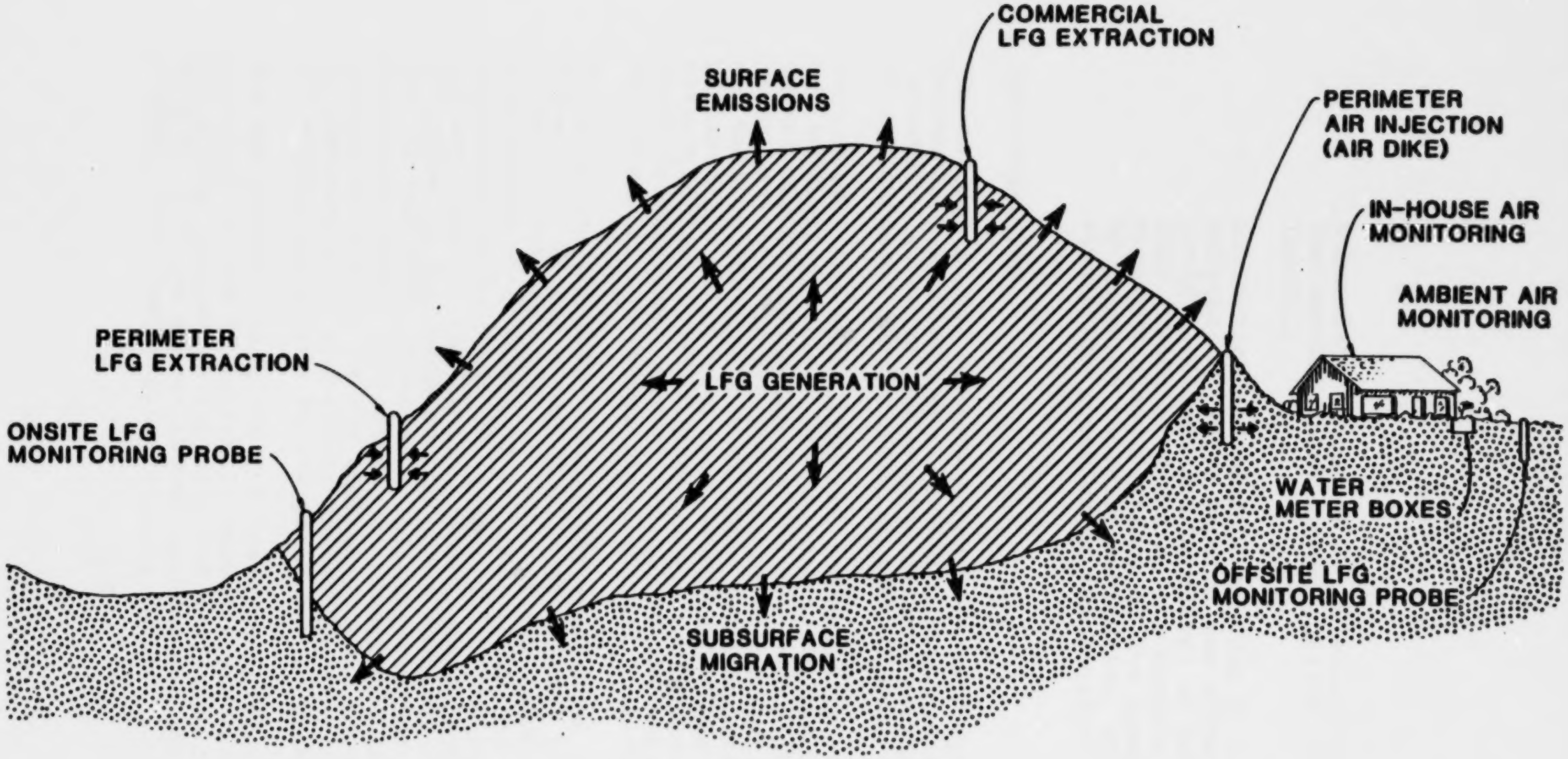

COMMERCIAL LFG EXTRACTION
SURFACE EMISSIONS
PERIMETER AIR INJECTION (AIR DIKE)
IN-HOUSE AIR MONITORING
AMBIENT AIR MONITORING
PERIMETER LFG EXTRACTION
LFG GENERATION
ONSITE LFG MONITORING PROBE
WATER METER BOXES
OFFSITE LFG MONITORING PROBE
SUBSURFACE MIGRATION
LEGEND
→ PATH OF LFG MIGRATION
▨ REFUSE

FIGURE 2
SCHEMATIC OF LFG MIGRATION
FROM OII LANDFILL SITE
OPERATING INDUSTRIES, INC. LANDFILL
OUFS-GAS MIGRATION CONTROL

- Subsurface migration by releases and diffusion through the bottom (below ground surface) boundaries of the landfill

- Collection and partial control by existing perimeter extraction, which removes gas along portions of the landfill slopes and boundary; by perimeter air injection, which provides an air curtain for partial containment along portions of the landfill boundary; and by existing interior extraction, which removes gas from within the interior of the landfill

GAS GENERATION

The estimated 1988 methane generation rate from the landfill is between 3.8 million and 5.2 million standard cubic feet per day (mmscfd). Although the average methane generation is decreasing, it may continue for 35 years or more (Figure 3).

During 1987 and early 1988 EPA installed 15 multiple completion gas monitoring wells. Probes were installed at up to six different depths, extending down to 340 feet. These probes are now being monitored by EPA for methane concentrations, gas pressure and sampled for analysis of other constituents in the gas stream. Contaminants which have been detected include benzene, carbon tetrachloride, 1,1-dichloroethane, 1,1-dichloroethylene, perchloroethylene, trans-1,2-dichloroethylene, trichloro ethylene, toluene, vinyl chloride, and 1,1,1-trichloroethane.

Probe monitoring data support the evaluation of subsurface LFG migration. In the areas of high subsurface LFG migration identified in the west and east ends of the landfill, the new probes also showed high levels of methane. With the exception of LFG monitoring wells (GMW) No. 2 and No. 3, the probes on the east and west ends of the landfill also showed high levels of methane extending to the depth of the waste mass within a radius of 1,000 feet of the probe location. This information from the deep monitoring probes indicated that subsurface LFG migration is occurring at greater depths than previously known, and supports the recommendation in the FS for installing deep LFG extraction wells and monitoring probes at the perimeter in these areas.

The EPA probes located in the areas identified as having low LFG migration in the FS generally showed lower concentrations than the probes located on the east and west ends of the landfill. Several of these probes showed methane concentrations exceeding 5 percent, the lower explosive limit (LEL).

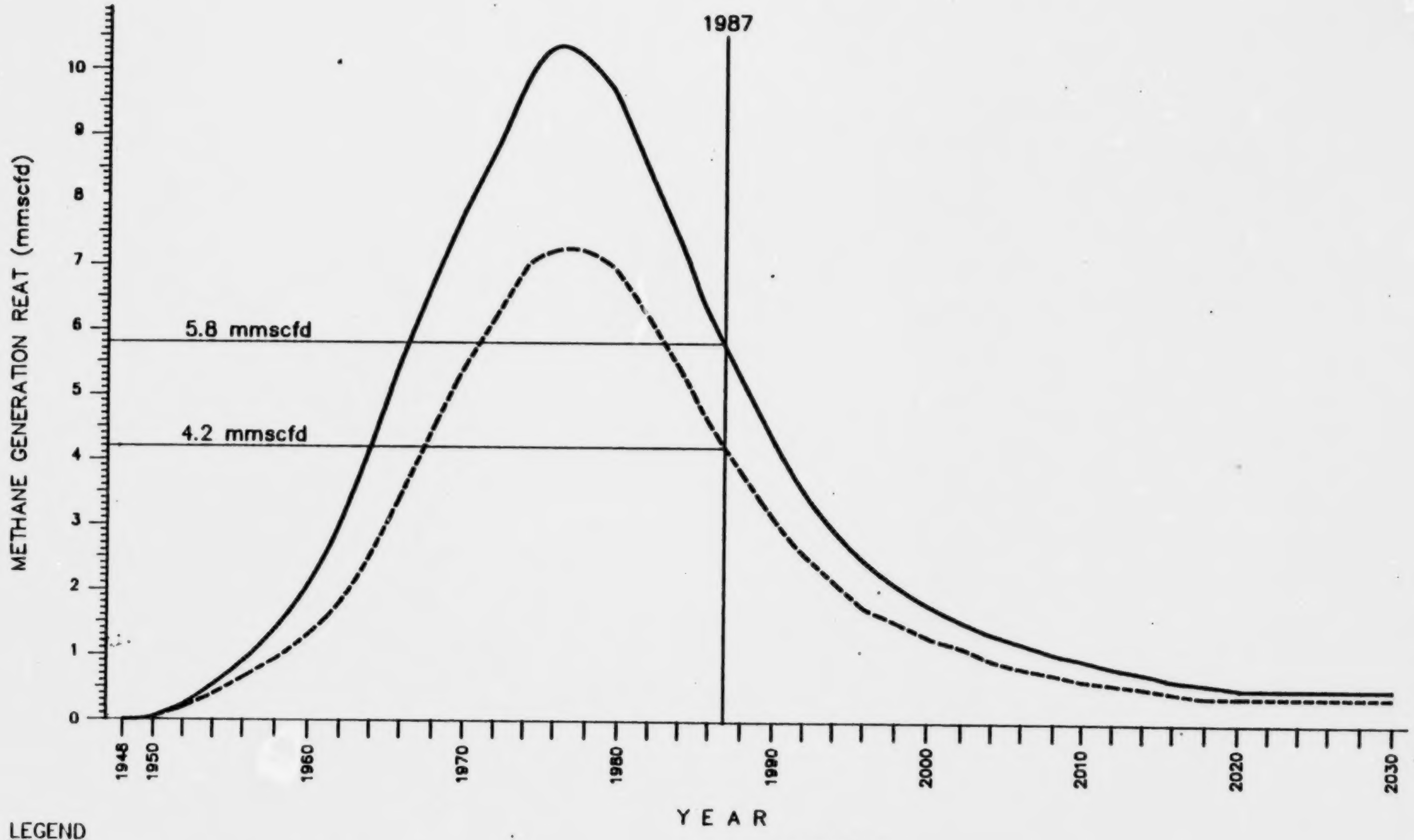


FIGURE 3
ESTIMATED MINIMUM AND MAXIMUM POTENTIAL METHANE GENERATION RATES VS TIME
OPERATING INDUSTRIES, INC. LANDFILL
OUFS-GAS MIGRATION CONTROL

Additional source control and perimeter extraction wells proposed for other areas may also reduce methane levels in this area. However, the new data indicates that additional gas extraction wells may be required in areas of low methane migration if methane concentrations above 5 percent persist. The number and placement of these wells will depend on future monitoring data.

In summary, new EPA monitoring probe data verifies the presence of methane at concentrations greater than 5 percent in both the shallow and deep probes in the previously identified high migration areas. The data supports the distinction between high and low migration, but indicates that some additional gas extraction wells may also be required in the low migration areas.

At the eastern boundary of the site, subsurface investigation conducted by Geotechnical Consultants, Inc. (GTC) indicated deposits of refuse within Chevron U.S.A. property. The approximate extent of refuse at the east end of the landfill is shown in Figure 4. This composite figure was prepared based on an existing topographic map of the landfill and the conclusions drawn by GTC.

Gas migrating in the subsurface on the Chevron property to the east of the site would be more effectively controlled with perimeter wells installed at the boundary of the refuse (which extends off the OII property in this area) rather than wells installed at the legal property boundary. The zone of influence of wells installed on the legal boundary would have to extend to the perimeter of the waste mass in order to control gas migration. Establishing such zones of influence within the waste mass could lead to excessive oxygen intrusion, creating the potential for underground fires. Smaller zones of influence within native soil could be used to control gas migration if the wells were installed at the boundary of the refuse. The gas control alternatives that involve increased gas extraction on the South Parcel have the flexibility for modification of the conceptual design for gas well and header placement, to better address gas control in this area. This modification consists of locating the perimeter wells and perimeter header line at the edge of the refuse and potentially redistributing a portion of the slope wells in this area. These modifications can be accomplished during the design phase without altering the cost estimates for the alternatives. Field work during the design phase will more precisely define the extent of refuse in this area.

Landfill gas is also being generated within the 11 acres of waste located on the North Parcel of the OII site as confirmed by field monitoring of EPA probes in 1987. A more detailed discussion of the LFG investigation can be found in the Preliminary North Parcel Site Characterization Report, March 4, 1988.

Methane concentrations of 5 to 82 percent were found in the probes placed within the waste mass and at the perimeter of the waste mass. Generally, during monitoring, LFG was found to be prevalent within the landfilled area, as well as at the northwestern and southwestern boundaries of the North Parcel. Lab analysis of LFG samples confirmed the presence of elevated levels of methane. Carcinogenic and toxic organic compounds were also found in the landfill gas.

Methane levels (and, for the most part, levels of carcinogenic and toxic compounds) were found to be lower on the eastern portion of the North Parcel outside of the fill area. EPA believes that the majority of the compounds present in this area are due to the migration of gas away from the landfill areas on the North and South Parcels. EPA presently assumes that control of the gas migration problems of the filled areas of the North and South Parcels should eliminate the existing gas problem on the eastern portion of the North Parcel. Based upon EPA evaluation of the volume of the waste mass and the age of the waste, the North Parcel is beyond the peak of methane generation and is producing approximately 9,000 to 14,000 cubic feet of methane gas per day.

Contaminant Release

LFG that is not collected by the gas collection systems and destroyed by flaring is released by surface emissions or migrates laterally through porous soil, and thus contributes to emissions offsite around the landfill.

A portion of the LFG generated in the landfill is released or emitted by venting mechanisms through the landfill cover. The heat generated by the biochemical reactions in the landfill increases the vapor pressure and the rate of volatilization of organic chemicals present in the waste. The molecular weight, reactivity, and water solubility of each chemical also affect volatilization. Once volatilized, the organic chemicals are transported with the LFG by dominant mechanisms such as diffusion, convection, and barometric pressure pumping.

These release mechanisms have been documented by data on emissions from the landfill surface. The areas onsite with the highest amount of emissions (measured as methane) appear to be

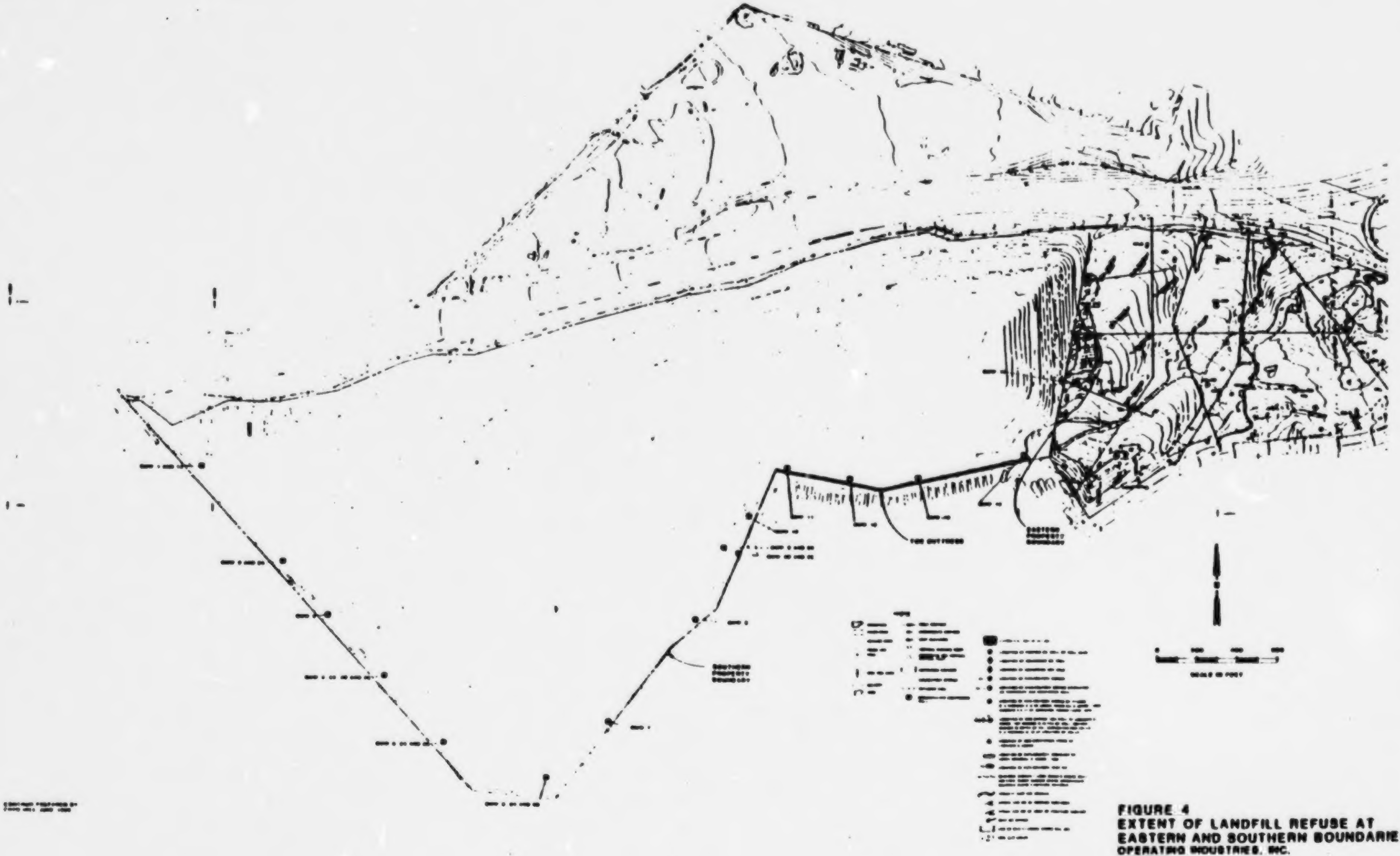


FIGURE 4
EXTENT OF LANDFILL REFUSE AT
EASTERN AND SOUTHERN BOUNDARIES
OPERATING INDUSTRIES, INC.
LANDFILL
OUFS-ADDENDUM

the slopes. The slopes have a thinner cover and are prone to surface erosion and instability causing fissures and cracks. These areas, which will be further monitored during the upcoming RI/FS air sampling tasks, also abut many residences.

Subsurface LFG migration is another release mechanism at the OII landfill. Methane has been detected in water meter boxes and offsite probe locations in the residential neighborhoods at concentrations above the lower explosive limit. Historically, the area to the northwest of the landfill has not exhibited detectable levels of methane in the water meter boxes. The neighborhood to the southwest has continued to exhibit elevated levels of methane despite the existing LFG migration control systems at the landfill.

Contaminant Transport Pathways

Contaminants contained in the LFG either migrate offsite in subsurface soils, or are emitted to the ambient air through the landfill cover. Subsurface migration primarily occurs by diffusion (due to concentration gradients) and convection (due to pressure gradients) through refuse and soil. Chemical contaminants are released to ambient air through the landfill cover onsite or via surface soils around the landfill offsite and are transported by wind and prevailing air drainage patterns.

Contaminants may also move through the void spaces in underground utility conduits. The water meter box data indicate that this has occurred and is still occurring in the southwest section.

Urban development adjacent to the OII site in the mid-1970s resulted in extensive grading and modifications of the original topography. Grading required for access roads and residential lots resulted in excavation of ridges and placement of fill in low areas. Replaced fill, unless compacted effectively, may be more permeable to LFG than undisturbed material.

Geologic formations, such as faults, may also act as pathways for migration. Several faults have been identified in the area.

SUMMARY OF SITE RISKS

A preliminary risk assessment was performed to evaluate the potential public health impacts. This assessment focused only on the LFG issues; other issues will be incorporated into the risk assessment for the site in the overall RI/FS.

As of December 1986, many of the water meter boxes that previously had high methane readings close to the landfill were vented to prevent the build up of methane or other volatile contaminants. The data collected prior to venting indicated the presence of methane in concentrations within the explosive range. Methane concentrations continue to exceed the lower explosive limit in some of these boxes, and additional venting is planned as part of the Site Control and Monitoring Remedial Action. These data are useful for demonstrating that subsurface migration is occurring and still presents a risk if allowed to build up to high concentrations in enclosed spaces. Venting of meter boxes does not eliminate the potential for fire and explosion, since homes, sheds and other enclosed spaces are adjacent to the site. The potential for fire and explosion can only be eliminated by controlling landfill gas to below the the explosive limit (5%) of methane.

Methane build-up in enclosed spaces has been demonstrated at the OII site and may pose an acute and imminent hazard due to the risk of fire and explosion. Methane is a highly flammable gas at concentrations between 5 percent (LEL) and 15 percent (UEL). The water meter box and offsite probe data demonstrate that methane gas has migrated offsite, and methane has accumulated to concentrations up to 70 percent by volume in the meter boxes. If air is added to the enclosed space and decreases the concentrations to within the combustible range, a spark, lighted cigarette, or match can cause an explosion.

The preliminary risk evaluation is based solely on the LFG problem and the chronic effects of LFG components such as benzene and vinyl chloride to humans over a long-term exposure at the site. Methods assessed in the operable unit to remediate the methane problem may also alleviate the other components (e.g., benzene and vinyl chloride).

The risks associated with exposure to volatile organic compounds (VOCs) are estimated for the residential and occupational scenarios with inhalation as the only exposure route considered. The inhalation route is considered in the OUFS risk assessment since it is the criterion to be used to determine feasible technologies for the gas problem. The ambient air data were assumed to represent the air quality inside the houses. In-house data indicated the potential presence of contaminants, but were not used for residential exposure because the data were of questionable quality.

The population potentially exposed to these contaminants includes 2,150 people within 1,000 feet of the landfill as demonstrated by available data.

Contaminants detected in at least 10 percent of the ambient air samples include benzene, carbon tetrachloride, perchloroethylene, trichloroethylene, vinyl chloride, 1,1,1-trichloroethane, and toluene. Of these vinyl chloride is the only compound for which there is an ambient air quality standard, which is 10 ppb. The mean concentration between August 1983, and August 1986, was 1.8 ppb, and the maximum concentration was 14 ppb. The standard was exceeded 16 days during this time period, with the last exceedance occurring on August 23, 1985.

More defined information will be available for the final risk assessment to be included in the overall RI/FS after additional ambient and in-house air monitoring data is collected.

Exposure is estimated based on EPA's Superfund Public Health Evaluation Manual (1986) and CH2M HILL Risk Assessment Guidance document (1986).

The daily chemical intakes via inhalation of noncarcinogens for a 70-kg adult and for 30-kg and 10-kg children in a residential setting were compared to acceptable intakes for chronic exposure (AIC). None of the contaminants exceeded the AIC. The daily chemical intake for the occupational scenario did not exceed the acceptable chronic or subchronic intake levels.

The Hazard Index for multiple exposures was calculated at less than one, therefore, no effect is expected to occur from exposure to the toxic chemicals at the levels found around OII.

The excess lifetime cancer risk was estimated at 1.6×10^{-4} for the residential setting and 5.4×10^{-5} for the occupational scenario. The cancer risk was dictated primarily by benzene and vinyl chloride. However, benzene was not detected in 85 percent of the samples collected and vinyl chloride was not detected in 50 percent of the samples. The detection limit for benzene was 5 ppb in 1983 and 2 ppb in 1984. Thus, the cancer risk was calculated using limited data, and was affected by sensitivity in the analytical technique. Additional data from upcoming ambient air monitoring should allow a distinction between the background risk posed by ambient air in the area, and additional risk posed by contaminants from the OII site. This risk assessment will be presented in the overall RI/FS for the site.

DOCUMENTATION OF SIGNIFICANT CHANGES

Alternatives 9 and 10 (the gas control system for the south parcel and the gas destruction facility, and the gas control system for the north parcel, respectively) were presented in the proposed plan as the preferred alternative. No significant changes have been made to these alternatives, although a modification of the conceptual design for the gas destruction facility may be required.

EPA originally proposed thermal destruction of the landfill gas using "flare" gas incinerators. The ARAR governing emissions from the thermal destruction of the landfill gas has been clarified (See the Statutory Determinations Section of the ROD). This ARAR limits emissions of CO to 550 pounds per day, and NOx to 100 pounds per day, and the exemption from the emissions offset requirements for landfill gas facilities is not allowable. Therefore, EPA may be required to either establish sufficient additional controls on the proposed landfill gas flares to achieve these requirements, or consider alternative gas incinerator designs which would allow further emissions controls.
This change constitutes a minor modification of the proposed remedy. Thermal destruction will still be utilized and this modification will not significantly affect the cost of the selected remedy. Additional control equipment for flare emissions could increase the cost of the flare facility by $1 million. Use of alternative incinerator designs may increase the remedy costs by $1 to $2 million. Since the cost of the proposed remedy was previously estimated at $73 million, with an accuracy range of -30% to +50%, the cost of the remedy is not significantly affected.

If the emissions requirement for landfill gas destruction cannot practicably be achieved, EPA will invoke the waiver from these requirements under SARA, on the grounds that compliance with these requirements would cause more damage to human health and environment (by preventing collection and destruction of landfill gas at OII) than waiving them.

Comments were received which suggested that additional interim cover or partial final cover should be applied on the slopes of the landfill as part of this Operable Unit to further improve control of surface landfill gas emissions. The Feasibility Study deferred cover options for landfill gas control due to data limitations which impacted the technical feasibility of cover evaluation, design, and construction at this time. However, the Feasibility Study did note that integration with the cover would be required for control of surface emissions from the site. As information becomes available from studies conducted by EPA and/or other parties, or from Site Control and Monitoring activities, EPA will consider the feasibility of integrating additional interim cover or partial final cover with the construction of the selected gas control remedy, and this activity may be added to this Operable Unit. If information becomes available to allow development and evaluation of conceptual cover designs an opportunity for public comment on proposed cover alternatives may be offered, as appropriate.

Several of the alternatives in the Feasibility Study included resource recovery components, however, these were found not to be cost-effective, and therefore, were not included in the preferred alternative. Although the selected remedy does not include design and construction of a resource recovery component, it does allow for EPA to decide to design and construct a resource recovery component in the future if resource recovery becomes cost-effective, and such a decision is consistent with EPA's other decision making criteria.

DESCRIPTION OF ALTERNATIVES

GOALS AND OBJECTIVES

The goals and objectives for remediation include:

- Limiting methane concentration to less than 5 percent at the site boundary
- Controlling surface emissions of LFG such that total organic compound concentration is less than 50 ppm on the average and methane concentration is less than 500 ppm at any point on the surface through integration of the gas control remedy and the final cover for the site. Although, prior to final cover placement an interim goal will be to reduce surface emissions to a significant degree, a waiver from full compliance with this ARAR will be required until the final remedy is implemented.
- Minimizing the odor nuisance - this is directly associated with the reduction of surface emissions, and consequently, although odor reduction will be achieved prior to final cover placement, integration with the final cover will be required to fully address this problem

- Attaining applicable or relevant and appropriate standards, requirements, criteria, or limitations under other federal and state environmental laws according to the terms of Section 121 of SARA (For an operable unit compliance with ARARs (such as surface emissions control) may be waived if compliance is expected to be achieved through implementation of the final remedy.)
- Expediting implementation - sequencing and phasing remedial activities to rapidly mitigate identified gas problems
- Providing consistency with final remedies - considering potential effects of future remedial activities in developing alternatives to mitigate and minimize identified gas problems
- Integrating gas operations - optimizing migration control by integrating perimeter and interior gas extraction systems
- Using resource recovery technologies to the maximum extent practicable if cost-effective

SUMMARY OF GAS FS ALTERNATIVES

The alternatives which underwent detailed evaluation in the FS ranged from maintaining the existing LFG systems, to extensive additional well placements to extract LFG. LFG destruction systems ranged from simple flares to a LFG-fired steam boiler with electrical power generation.

Two of the alternatives included a resource recovery element that uses LFG combustion to generate steam and drive steam turbine electrical generators. These could provide electricity for sale to the local utility company.

Except for Alternatives 0 and 1 (no action and status quo, respectively), the emphasis of the alternatives is on increased collection and destruction or utilization of the LFG through thermal destruction. Other gas cleaning or processing technologies were eliminated during the initial screening of alternatives. Alternatives 1 through 9 are possible remedies for the south parcel and alternative 10 is for the north parcel.

Alternative 0

No Action. Walk away, cease extraction system and air dike operation.

Alternative 1

Status Quo. Operate existing systems as is.
- Air dike--31 wells
- OII system (scope wells)--79 wells
- GSF system--64 wells
- GSF flare station--1 blower, 1 flare
- OII flare station--3 blowers, 3 flares

Methane collected--2.0 million standard cubic feet per day
- Percent of methane generated--52 percent
- Percent increase--0 percent

Alternative 2

Improve Alternative 1 by replacing the header line abovegrade, collecting condensate, and modifying, improving, and integrating the flare facilities.

Alternative 3

Minimal Additional Gas Extraction. Expansion of Alternative 2.
- Replace air dike with extraction wells
- 29 new perimeter wells
- 25 new interior wells
- New perimeter probes to monitor performance

Methane collected--2.4 million standard cubic feet per day
- Percent of methane generated--63 percent
- Percent increase--22 percent

Alternative 4

Intermediate Additional Gas Extraction. Expansion of Alternative 2.
- Replace air dike with extraction wells
- 41 new perimeter wells
- 63 new interior wells
- New perimeter probes to monitor performance
- 1 new blower, and 1 new flare

Methane collected--2.9 million standard cubic feet per day

- Percent of methane generated--77 percent
- Percent increase--50 percent

Alternative 5

Maximum Additional Gas Extraction. Expansion of Alternative 2.

- Replace air dike with extraction wells
- 56 new perimeter wells
- 96 new interior wells
- New perimeter probes to monitor performance
- 2 new blowers, 2 new flares

Methane collected--3.4 million standard cubic feet per day

- Percent of methane generated--90 percent
- Percent increase--78 percent

Alternative 6

Alternative 5 with gas boiler and steam generator added.

- Net electric output--6.1 mw
- Net revenues--$2.4 million
- Duration of electric generation--10 years

Alternative 7

Replacement of existing systems with a completely new system.

- 59 new perimeter wells
- 180 new interior wells
- New perimeter probes to monitor performance
- 6 new blowers, 6 new flares

Methane collected--3.4 million standard cubic feet per day

- Percent of total methane--90 percent
- Percent increase--78 percent

Alternative 8

Alternative 7 with gas boiler and steam generator. Uses the same resource recovery system as Alternative 6.

Alternative 9

Modified Alternative 7. Uses existing gas extraction wells.

- 58 new perimeter wells
- 110 new interior wells

- 105 existing wells
- New perimeter probes to monitor performance
- 6 new blowers, 6 new flares

Methane collected--3.4 million standard cubic feet per day
- Percent of total methane--90 percent
- Percent increase--78 percent

Alternative 10

North Parcel System.
- 6 new wells and header line
- Existing LFG monitoring probes
- Integrated with South Parcel alternative for LFG destruction

Methane collected--.009 to .014 million standard cubic feet per day

In the FS, remedial action alternatives are described in sufficient detail to develop order-of-magnitude cost estimates (-30 to +50 percent) and to allow comparison of alternatives. They are based on the existing site data and understanding of site conditions as well as estimates of future conditions. Information presented concerning sizing of equipment, LFG flows, and extracted LFG quality is preliminary and is useful for evaluation and comparison of alternatives. Values to be used for design will be re-evaluated in the predesign or final design efforts. In addition, data collected as part of continuing site remedial investigation efforts will supplement understanding of current site conditions and may help in optimizing an alternative. Variations in design could include:

- Number and placement of components such as header lines and extraction wells

- Extraction rates

- LFG quality (constituent concentration).

It should also be noted that Alternatives 2 through 8 include facilities for the collection of condensate and/or leachate which result from LFG migration control remedial actions. However, facilities and costs associated with condensate and leachate treatment and/or disposal are not included in these alternatives. Leachate and condensate will be managed under EPA's Leachate Management Remedial Action.

SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

Alternative Nos. 0 through 2 are not acceptable gas control alternatives because the quantity of LFG collected would remain the same or decrease. The potential threat from fire and explosion, and contamination of the ambient air from surface emissions would continue.

Alternative No. 3 would provide additional partial control of LFG in some areas. However, control of subsurface migration to less than 5 percent methane and surface emissions to the SCAQMD requirements (when the final cover is implemented) are not expected to be achieved. Therefore, the potential threat from fire and explosion and the contamination of the ambient air from surface emissions would continue. The remedial goals and objectives, including overall protection of human health and the environment, compliance with ARARs, and long and short-term effectiveness would not be met.

Alternative No. 4 could possibly achieve control of subsurface migration and surface emissions in compliance with ARARs. However, this level of control is not considered to be likely. If this alternative does not achieve the ARARs, then the potential threat of fire and explosion and contamination of ambient air could continue, therefore this is not considered an effective alternative.

Alternative Nos. 5, 6, 7, 8 and 9 all have a high probability of controlling subsurface migration and surface emissions (when integrated with the final cover) to achieve ARARs. This level of control will eliminate the threat of fire and explosion and should reduce the amount of contaminants released to the ambient air to protective levels. These alternatives are, therefore, protective of public health and environment. All of these alternatives (5 through 9) are considered roughly equivalent in their effectiveness and implementability.

Alternative Nos. 6 and 8 include electrical generation resource recovery from the LFG. An economic analysis found that the net costs of implementation and operation and maintenance would be increased rather than reduced by these alternatives because the benefit to cost ratios for the resource recovery technologies are less than one. Therefore, these two alternatives were not found to be cost-effective.

Alternative 9 is more cost-effective than alternatives 5 and 7 because it uses existing wells and alternative well installation techniques. The 30-year present worth cost for this alternative (using a 3 percent discount rate) is estimated at $72 million, compared to $90 million for Alternative 5 and $96 million for Alternative 7. This alternative is also more reliable than Alternative 5 due to the complete replacement of the gas extraction and flaring facilities, and is therefore considered to offer better short and long-term effectiveness.

Alternative 10 is a separate component that will control gas migration in the subsurface and surface emissions from the North Parcel. This alternative is readily implementable and can be integrated with Alternative 9 which will provide LFG extraction and destruction facilities. The 30-year present worth cost of Alternative 10 is $1.1 million.

Tables 1 and 2 provide a brief comparison summary of the alternatives. These tables present information on EPA's decision making criteria of capital, operations and maintenance, and present worth costs, effectiveness, and compliance with ARARs. Table 3 provides a more detailed comparison of the alternatives. This table presents information on EPA's decision making criteria of overall protection of human health and environment (both short- and long-term effectiveness and permanence), implementability, and compliance with ARARs.

EPA's selected remedy is a combination of Alternatives 9 and 10. It offers a degree of protection of public health and environment that exceeds that of Alternatives 0 through 4, is equivalent to the protection offered by Alternatives 5 through 8, and is readily implementable.

The State of California, Department of Health Services, the Regional Water Quality Control Board, the City of Montebello, and the Los Angeles County Department of Health Services all support the selection of Alternatives 9 and 10 as the selected remedy. The local community group, H.E.L.P., Homeowners to Eliminate Landfill Problems, also support the selection of Alternatives 9 and 10.

The California Waste Management Board, and one local community member preferred Alternative 7 over Alternative 9, because they were opposed to the inclusion of functional existing gas extraction wells at OII. EPA considers it to be more cost-effective to include these functional wells rather than replacing them unnecessarily. EPA's selected remedy provides money to replace these wells when they are no longer functional, as part of yearly operations and maintenance.

Table 1
ALTERNATIVES COMPARISON SUMMARY
OII LFG MIGRATION CONTROL

Alternative			Effectiveness		Cost Estimates[a] ($ Millions)	
No.	Description	Innovative or Resource Recovery Technology	Estimated Additional LFG Collection (%)[b]	Probability of Meeting or Exceeding ARARs	Capital Investment	O/M[c]
0	No Action	No	-	No	0	0
1	Status Quo	No	0	No	0	1.6
2	Improved Status Quo	No	0	No	5.8	1.5
3	Minimal Gas Extraction with LFG Flaring	No	+20	Partially	15.5	2.0
4	Intermediate Gas Extraction with LFG Flaring	No	+45	Possibly	23.3	2.5
5	Maximum Gas Extraction with LFG Flaring	No	+70	High Probability	32.1	3.0
6	Maximum Gas Extraction with LFG Boiler and Steam Power Generation	Yes	+70	High Probability	46.6	1.4[d] 3.0[e]
7	Replacement Gas Extraction with LFG Flaring	No	+70	High Probability	45.3	2.6
8	Replacement Gas Extraction with LFG Boiler and Steam Power Generation	Yes	+70	High Probability	59.8	1.0[d] 2.6[e]
9	Modified Replacement Gas Extraction with LFG Flaring	No	+70	High Probability	27	2.3
10	North Parcel System	No	+70	High Probability	0.4	0.038

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[a] These costs are order-of-magnitude level estimates (i.e., the cost estimates have an expected accuracy of -30 to +50 percent).

[b] Percent increase over projected (based on LFG generation model) LFG collected in 1990 using existing LFG facilities.

[c] Operation/Maintenance, net estimated annual costs, 30 years, rounded off.

[d] Operation/Maintenance, net estimated annual costs, 0-10 years, rounded off.

[e] Operation/Maintenance, net estimated annual costs, 11-30 years, rounded off.

Table 2
NET PRESENT WORTH OF ALTERNATIVES

Alternative	Project Life	Present Worth Rates ($ millions)		
		@3%	@5%	@10%
1	30 years	31.1	24.4	15.0
	45 years	37.5	27.2	15.1
	60 years	41.4	28.3	14.9
2	30 years	35.3	29.0	20.0
	45 years	41.6	31.7	20.2
	60 years	45.5	32.9	20.2
3	30 years	54.1	45.7	34.0
	45 years	62.3	49.4	34.3
	60 years	67.6	51.1	34.3
4	30 years	71.5	61.1	46.5
	45 years	82.1	65.9	46.9
	60 years	88.8	68.1	46.9
5	30 years	90.0	77.5	60.0
	45 years	103.0	83.5	60.6
	60 years	111.2	86.2	60.6
6	30 years	94.0	82.2	67.7
	45 years	107.0	88.8	68.4
	60 years	115.3	91.5	68.4
7	30 years	96.1	85.2	69.8
	45 years	107.6	90.4	70.3
	60 years	114.9	92.9	70.3
8	30 years	100.2	90.5	77.5
	45 years	111.6	95.8	78.1
	60 years	119.0	98.0	78.1
9	30 years	71.6	61.9	48.4
	45 years	81.5	66.5	48.8
	60 years	87.9	68.6	48.9
10	30 years	1.1	1.0	0.8
	45 years	1.2	1.0	0.7
	60 years	1.2	1.0	0.7

Table 3
EFFECTIVENESS EVALUATION OF ALTERNATIVES

Effectiveness Criteria	Alternative 0	Alternative 1	Alternative 2
Protectiveness of Human Health and the Environment			
o Estimated reduction in methane normally released as surface emissions and subsurface migration[a]	None	None	None
o Surface emissions control - comply with ARARs (less than 50 ppm average; 500 ppm maximum at any point); compliance requirement deferred to the final remedy	Will not comply	Will not comply	Will not comply
o Subsurface migration control - comply with ARARs (less than 5 percent at the boundary)	Will not comply	Will not comply	Will not comply
o Source control - LFG collection at the source	None	No additional source control	No additional source control
o Resource recovery	None	None	None
o Odor control	None	Inadequate	Inadequate
Reliability			
o Potential for poor performance or failure of system components (assuming design criteria represent actual field conditions)	NA	Poor reliability as evidenced by current operational problems at site	Improved reliability Slight reduction (not estimatable) due to system improvements
o Operational flexibility to address variations between design criteria and actual field conditions	NA	NA	System improvements are expected to allow greater flexibility in flare system operation and header maintenance

Table 3
(Continued)

Effectiveness Criteria	Alternative 3	Alternative 4	Alternative 5
Protectiveness of Human Health and the Environment			
o Estimated reduction in methane normally released as surface emissions and subsurface migration	Reduction estimated at 0.4 mmscfd (22 percent reduction in methane release)	Reduction estimated at 0.9 mmscfd (50 percent reduction in methane release)	Reduction estimated at 1.4 mmscfd (78 percent reduction in methane release)
o Surface emissions control - comply with ARARs (less than 50 ppm average; 500 ppm maximum at any point); compliance requirement deferred to the final remedy	Additional extraction wells on slopes; monitoring data required to determine compliance; more likely to comply than Alternatives 1 and 2	More wells on slopes than Alternative 3; more likely to comply than Alternatives 2 and 3	Maximum well coverage of "add on" alternatives, more likely to comply than Alternative 4. High probability of compliance.
o Subsurface migration control - comply with ARARs (less than 5 percent at the boundary)	Additional extraction wells at the landfill perimeter; monitoring data required to determine compliance; not likely to comply	More wells on perimeter than Alternative 3; more likely to comply than Alternatives 2 and 3	Maximum well coverage of "add on" alternatives, more likely to comply than Alternative 4. High probability of compliance.
o Source control - LFG collection at the source	Additional interior wells will collect more LFG from within the refuse than Alternatives 1 and 2	More interior wells than Alternative 3 will collect more LFG	Maximum well coverage of "add on" alternatives; should provide greater degree of source control than Alternative 4.
o Resource recovery	None	None	None
o Odor control	Some reduction from additional wells on landfill slopes	Greater reduction in odors than Alternative 3	Greater reduction in odors than Alternatives 3 and 4
Reliability			
o Potential for poor performance or failure of system components (assuming design criteria represent actual field conditions)	Low; costs include periodic replacement of equipment, standby gas blower, and flare capacity	Reliability of LFG collection and flaring is same as Alternative 3	Reliability of LFG collection and flaring is same as Alternative 3
o Operational flexibility to address variations between design criteria and actual field conditions	Liquid/leachate pump provided for each well if necessary; use of oversized collection headers to allow additional well installations, flexibility limited by existing systems layout (i.e., header configuration and well design and placement).	Same as Alternative 3	Same as Alternative 3

Table 3
(Continued)

Effectiveness Criteria	Alternative 6	Alternative 7	Alternative 8
Protectiveness of Human Health and the Environment			
o Estimated reduction in methane normally released as surface emissions and subsurface migration	Reduction estimated at 1.4 mmscfd (78 percent reduction in methane release)	Reduction estimated at 1.4 mmscfd (78 percent reduction in methane release)	Reduction estimated at 1.4 mmscfd (78 percent reduction in methane release)
o Surface emissions control - comply with ARARs (less than 50 ppm average; 500 ppm maximum at any point); compliance requirement deferred to the final remedy	Same as Alternative 5	Greatest potential for control due to integration of complete system through design and construction does not rely on existing well locations and header configuration. Improved reliability enhances protectiveness.	Same as Alternative 7
o Subsurface migration control - comply with ARARs (less than 5 percent at the boundary)	Same as Alternative 5	Greatest potential for control due to integration of complete system through design and construction does not rely on existing well locations and header configuration. Improved reliability enhances protectiveness.	Same as Alternative 7
o Source control - LFG collection at the source	Same as Alternative 5	Greatest potential for control due to integration of complete system through design and construction does not rely on existing well locations and header configuration. Improved reliability enhances protectiveness.	Same as Alternative 7
o Resource recovery	Power generation with LFG boiler/steam turbine generator; an estimated 6000 kW of power may be recovered	None	Power generation with LFG boiler/steam turbine generator; an estimated 6000 kW of power may be recovered
o Odor control	Same level of odor control as Alternative 5	Greatest potential for control due to integration of complete system through design and construction does not rely on existing well locations and header configuration. Improved reliability enhances protectiveness.	Same level of odor control as Alternative 7

Table
(Continued)

Effectiveness Criteria	Alternative 6	Alternative 7	Alternative 8
Reliability			
o Potential for poor performance or failure of system components (assuming design criteria represent actual field conditions)	Reliability of LFG collection and flaring is same as Alternative 3; power generation equipment requires high maintenance and is less reliable than other components	Reliability of LFG collection and flaring is greater than for all other alternatives because all facilities are new	Reliability of LFG collection and flaring is same as Alternative 3; power generation equipment requires high maintenance and is less reliable than other components. Overall reliability better than Alternative 6 but less than Alternative 7.
o Operational flexibility to address variations between design criteria and actual field conditions	Same as Alternative 3	Greatest flexibility, installation of complete new system is not tied to existing flare facilities, existing header configuration, or well design and location.	Same as Alternative 3

NA = Not Applicable.

[a] Reduction of methane normally released as surface emissions and subsurface migration are based on LFG generation and loss estimates projected for 1990. Normal methane losses in 1990 are defined as those that would occur utilizing existing facilities (e.g., as in Alternatives 1 and 2). Methane loss reductions presented are approximations based on assumptions and theoretical calculations. They are useful for purposes of comparing alternatives but do not reflect actual values.

Table 3
(Continued)

Effectiveness Criteria	Alternative 9	Alternative 10
Protectiveness of Human Health and the Environment		
o Estimated reduction in methane normally released as surface emissions and subsurface migration[a]	Reduction estimated at 1.4 mmscfd (78 percent in methane release) methane per day.	Reduction of estimated release of about 11,500 cubic feet of methane per day
o Surface emissions control - comply with ARARs (less than 50 ppm average; 500 ppm maximum at any point); compliance requirement deferred to the final remedy	Greater than Alternative 5, approximately equal to Alternative 7 once existing wells are replaced. High probability of compliance.	Likely to comply with the requirements
o Subsurface migration control - comply with ARARs (less than 5 percent at the boundary)	Greater than Alternative 5, approximately equal to Alternative 7 once existing wells are replaced. High probability of compliance when integrated with the final cover.	Most likely to comply with the requirements
o Source control - LFG collection at the source	Greater than Alternative 5, approximately equal to Alternative 7 once existing wells are replaced. High probability of compliance	Maximum well coverage
o Resource recovery	None	None
o Odor control	Greater than Alternative 5, approximately equal to Alternative 7 once existing wells are replaced. High probability of compliance	Would cut down odor nuisance with high probability of compliance.
Reliability		
o Potential for poor performance or failure of system components (assuming design criteria represent actual field conditions)	Reliability is high. All facilities other than existing wells will be new. Reliability will be the same as Alternative 7 when new wells are replaced.	Reliability is high and would increase with a new cap
o Operational flexibility to address variations between design criteria and actual field conditions	With the exception of existing well locations, great flexibility, installation of new system no tied to existing header configurations or flare facilities. Easier installation of pile driven and single completion wells improves flexibility	Use of oversize headers allows additional well installation

Ta[illegible]
IMPLEMENTABILITY EVALUATION OF ALTERNATIVES

Implementability Criteria	Alternative 0	Alternative 1	Alternative 2
Technical Feasibility			
o Use of proven technology	N/A	Gas extraction wells and gas flaring are currently used.	Gas extraction wells and gas flaring are currently used.
o Ease of installation and time to implement	N/A	N/A	Replacement and improvement of existing systems can be implemented within 1 year of project initiation.
o Short-term construction-related environmental impacts	N/A	N/A	Noise, LFG emissions, odors, and dust during excavation to be controlled.
o Short-term construction-related health risks	N/A	N/A	Potential contact with hazardous wastes. Requires appropriate health and safety procedures.
o Operational problems and considerations	N/A	Header line breakages; inadequate condensate collection; corrosion of equipment; lack of adequate safety and backup systems.	Problems should be reduced by recommended improvements.
Availability of Technology	N/A	N/A	Demonstrated technology in LFG applications. Equipment for gas extraction and flaring system improvements is readily available.
Operations and Maintenance	N/A	Continuation of existing long-term operating, maintenance, and monitoring of LFG facilities and site.	Requires long-term operating, maintenance, and monitoring of LFG facilities and site.
Administrative Feasibility			
o Administration of operating, maintenance, monitoring, and reporting activities	N/A	Continuation of existing operations.	Continuation of existing operations.
o Permitting considerations	N/A	None.	None.

N/A = Not applicable

Table 3
(Continued)

Implementability Criteria	Alternative 3	Alternative 4	Alternative 5
Technical Feasibility			
o Use of proven technology	Gas extraction wells and.gas flaring are currently used.	Gas extraction wells and gas flaring are currently used.	Gas extraction wells and gas flaring are currently used.
o Ease of installation and time to implement	Straightforward; less than 2 years estimated for implementation. Well construction on slopes more difficult than perimeter wells.	Straightforward, but more wells installed; less than 2 years estimated for implementation. Well construction on slopes more difficult than perimeter wells.	Straightforward, but more wells installed; less than 2 years estimated for implementation. Well construction on slopes more difficult than perimeter wells.
o Short-term construction-related environmental impacts	Noise, LFG emissions, odors, and dust during drilling/excavation to be controlled.	Noise, LFG emissions, odors, and dust during drilling/excavation to be controlled.	Noise, LFG emissions, odors, and dust during drilling/excavation to be controlled.
o Short-term construction-related health risks	Potential contact with hazardous waste. Requires appropriate health and safety procedures.	Greatest potential for contact with hazardous waste. Requires appropriate health and safety procedures.	Greatest potential for contact with hazardous waste. Requires appropriate health and safety procedures.
o Operational problems and considerations	Problems are minimized by implementation of improvements recommended in Alternative 2.	Problems are minimized by implementation of improvements recommended in Alternative 2.	Problems are minimized by implementation of improvements recommended in Alternative 2.
Availability of Technology	Demonstrated technology in LFG applications. Equipment and supplies for gas extraction well installation and flare system expansion are available.	Demonstrated technology in LFG applications. Equipment and supplies for gas extraction well installation and flare system expansion are available.	Demonstrated technology in LFG applications. Equipment and supplies for gas extraction well installation and flare system expansion are available.
Operations and Maintenance	Requires long-term operating, maintenance, and monitoring of LFG facilities and site. Requires special personnel safety procedures due to potential hazard associated with LFG.	Same as Alternative 3, but larger in scope due to larger system.	Same as Alternatives 3 and 4, but larger in scope due to larger system.
Administrative Feasibility	Alternatives 5 and 6 should include permits required for expanded flare station. Permits for Alternative 3 are incomplete.		

Tab
(Continued)

Implementability Criteria	Alternative 6	Alternative 7	Alternative 8
Administrative Feasibility			
o Administration of operating, maintenance, monitoring, and reporting activities	Larger scope than Alternatives 1 and 2.	Larger scope than Alternatives 1, 2, 3, and 4.	Larger scope than Alternatives 1, 2, 3, and 4.
o Permitting considerations expanded gas flaring system.	SCAQMD permits required for	Same as Alternative 3.	Sames as Alternative 3.
Technical Feasibility			
o Use of proven technology	Gas extraction wells and gas flaring are currently used at site. Boiler/steam turbine systems are widely employed.	Gas extraction wells and gas flaring are currently used at site.	Gas extraction wells and gas flaring are currently used at site. Boiler/steam turbine systems are widely employed.
o Ease of installation and time to implement	Same difficulty as Alternative 5; less than 2 years estimated for implementation.	Straightforward; more difficult than Alternatives 5 and 6 due to number of wells installed; less than 2 years estimated for implementation.	Straightforward; more difficult than Alternatives 5 and 6 due to number of wells installed; less than 2 years estimated for implementation.
o Short-term construction-related environmental impacts	Noise, LPG emissions, odors, and dust during drilling/excavation to be controlled.	Noise, LPG emissions, odors, and dust during drilling/excavation to be controlled.	Noise, LPG emissions, odors, and dust during drilling/excavation to be controlled
o Short-term construction-related health risks	Potential contact with hazardous waste. Requires appropriate health and safety procedures.	Potential contact with hazardous waste. Requires appropriate health and safety procedures.	Potential contact with hazardous waste. Requires appropriate health and safety procedures.
o Operational problems and considerations	Problems are reduced by implementation of improvements recommended in Alternative 2.	Problems are minimized by replacement of all existing facilities.	Problems are minimized by replacement of all existing facilities.
Availability of Technology	Same as Alternative 5. Boiler/steam turbine systems are readily available process equipment.	Same as Alternative 5.	Same as Alternative 5. Boiler/steam turbine systems are readily available process equipment.
Operations and Maintenance	Same as Alternative 5, but larger in scope.	Same as Alternative 5, but larger in scope.	Same as Alternative 5, but larger in scope.

Table 3
(Continued)

Implementability Criteria	Alternative 6	Alternative 7	Alternative 8
Administrative Feasibility			
o Administration of operating, maintenance, monitoring, and reporting activities	Larger scope than Alternative 5.	Same as Alternative 5.	Same as Alternative 6.
o Permitting considerations	Backup flaring systems must meet SCAQMD permitting requirements. Boiler NO_x emissions are minimized by ammonia injection process; emissions can be verified after installation.	Flaring systems must meet SCAQMD permitting requirements.	Backup flaring systems must meet SCAQMD permitting requirements. Boiler NO_x emissions are minimized by ammonia injection process; emissions can be verified after installation.

Ta
(Continued)

Implementability Criteria	Alternative 9	Alternative 10
Technical Feasibility		
o Use of proven technology	Gas extraction wells and gas flaring are currently used at site	Gas extraction wells and gas flaring are currently used at South Parcel
o Ease of installation and time to implement	Straightforward, less difficult than Alternative 7 due to fewer new well installations and easier installation methods; less than 2 years estimated for implementation	Easier installation methods; estimated less than 1-year time for implementation
o Short-term construction-related environmental impacts	Noise, LFG emissions, odors, and dust during drilling/excavation to be controlled.	Noise, LFG emissions, odors and dust during drilling excavation would be controlled.
o Short-term construction-related health risks	Potential contact with hazardous waste. Requires appropriate health and safety procedures. Pile driven wells reduce potential for hazardous waste contact.	Potential contact with hazardous waste. Requires appropriate health and safety procedures.
o Operational problems and considerations	Problems are minimized by replacement of all existing facilities, excluding functional extraction wells.	Problems will be minimized with proper design of extraction wells.
Availability of Technology	Demonstrated technology in LFG applications. Equipment and supplies for gas extraction well installation and flare system construction are available.	Demonstrated technology. Equipment and materials readily available.
Operations and Maintenance	Requires long-term operation and maintenance, and monitoring of LFG facilities and site. Requires special personnel safety procedures due to potential hazards associated with LFG.	Requires long-term operation and maintenance including monitoring. Requires trained personnel for safety procedures due to potential hazards associated with LFG.
Administrative Feasibility		
o Administration of operating, maintenance, monitoring, and reporting activities	Same as Alternatives 5 and 7	Same as other alternatives
o Permitting considerations	Same as Alternative 3	Same as other alternatives

SELECTED REMEDY - ALTERNATIVES 9 AND 10

ALTERNATIVE NO. 9--MODIFIED REPLACEMENT ALTERNATIVE

Although this alternative considers fewer new extraction wells than Alternative No. 7, it is designed to provide approximately the same level of protection by using existing extraction wells. This alternative includes the following major items:

- Installing 58 new perimeter LFG extraction wells, as shown in Figure 5, with placement focused on minimizing offsite LFG migration.
- Installing 48 pile driven wells on the top deck of the landfill with placement focused on maximizing source control of LFG.
- Installing 50 shallow and 12 deep slope wells with placement focused on reducing surface emissions, and controlling intermediate to deep subsurface migration at the perimeter.
- Installing new integrated perimeter and interior LFG headers (abovegrade).
- Including functional existing gas extraction wells and gas monitoring probes.
- Installing 58 multiple completion monitoring wells at the property boundary.
- Installing landfill gas destruction facilities with a capacity of approximately 9,000 cfm, and an automated control station for the gas control system.
- Installing abovegrade condensate sumps to collect condensate from gas headers.
- Installing leachate pumps in gas wells to de-water saturated zones, and installing abovegrade leachate sumps.

The LFG extraction wells proposed in this alternative will be cross-tied such that all gas collected from the landfill can be mixed and sent to a unified gas destruction facility.

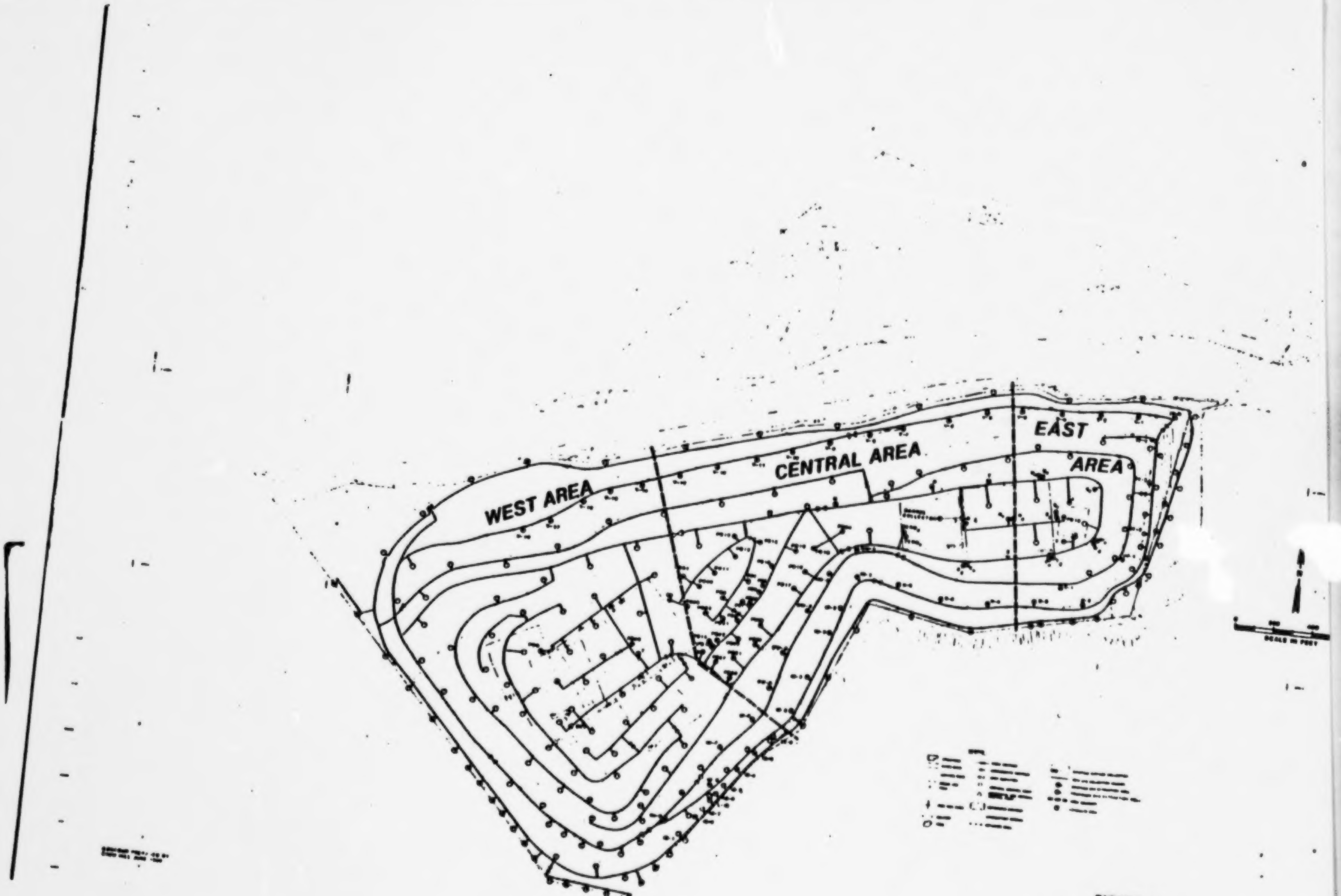

WEST AREA
CENTRAL AREA
EAST AREA

FIGURE 6
ALTERNATIVE 9
OPERATING INDUSTRIES, INC.
LANDFILL
OUFS - ADDENDUM

Well Construction

Four different types of gas extraction wells have been considered and included in Alternative No. 9 for control of the South Parcel LFG problems. The selection of different types of wells for different locations was based on landfill geometry, refuse characteristics, subsurface geology, and the expected effectiveness in controlling LFG at specific locations identified earlier in the OUFS report.

Initially, emphasis will be placed on perimeter extraction wells along the west and east ends of the landfill, where the most severe migration problems have been identified. Perimeter gas extraction wells at these locations will be drilled to depths equal the elevations of deepest refuse within 1,000 feet from the site boundary. Additional perimeter extraction wells will be sequenced according to a phased approach discussed under "Phasing of Alternatives." Perimeter extraction wells will be constructed as multiple completion wells with three or more well casings and screens at three or more depth intervals.

Wells on the slopes, particularly on the benches, will be drilled to a depth of between 60 to 90 feet by a drilling and/or driving method. These wells will be constructed with a single well casing with perforations and gravel packing at the bottom half of the well. In addition, to assist in perimeter migration control, about 12 deep single-casing wells are planned to be installed at the first bench. These wells would be installed along the west and east ends of the landfill. Along these boundaries, it is expected that approximately every third slope well on the first bench will be a deep well. The depth of such wells would be approximately 175 feet. Specific design of these deep wells would depend on conditions encountered during drilling.

Additional gas extraction wells will be placed on the top deck. These wells will be pile driven. The depth of these wells will be extended below the elevation of 450 feet throughout the landfill. At the western end of the landfill, depths may vary due to the suspected liquid/leachate problem.

Expected Longevity of Gas Extraction Wells

The expected longevity of each type of well discussed above depends on various landfill factors, quality of construction methods, and long-term operation and maintenance procedures.

Wells constructed within the refuse will experience wear and tear from the landfill settlement, corrosion and plugging of wells from landfill liquid/leachate, and from particulates/ sediment deposits clogging up well screens. Based on experience from the existing landfill gas extraction systems in Southern California, it is estimated that the wells within refuse will have an average life of 7.5 years. This estimate may be further revised based on actual drilling and construction experience encountered at site-specific locations.

Wells drilled within the native soil, specifically at the landfill perimeter, are expected to last longer. Average life expectancy of these wells is assumed to be 15 years. This expected longevity of the perimeter wells is based on information made available to EPA by the L.A. County Sanitation District.

As existing wells utilized by the South Parcel Alternative No. 9 require replacement, the location and design of the replacement will be optimized to improve performance.

The capital cost of Alternative 9 is estimated at approximately $27 million, and annual operations and maintenance is estimated at $2.3 million as shown in Table 4 (estimates are -30% to +50%).

ALTERNATIVE NO. 10--NORTH PARCEL SYSTEM

EPA's remedial investigation at the North Parcel found LFG within the landfilled portion of the site. This landfilled area contains approximately half a million cubic yards of refuse, and it is estimated that some gas will be produced for more than 30 years due to the continued anaerobic degradation of the refuse.

Based on the volume and depth of refuse, a conceptual layout of six gas extraction wells to control gas migration/emission from the North Parcel was prepared. (Figure 6 represents the schematic layout of the extraction system.) This extraction system will control existing and potential migration of gases from the property boundary and mitigate surface emissions from the landfilled portion of the North Parcel. This component includes the following major items:

- Installing 6 single completion extraction wells to the depth of refuse (up to 50 feet).

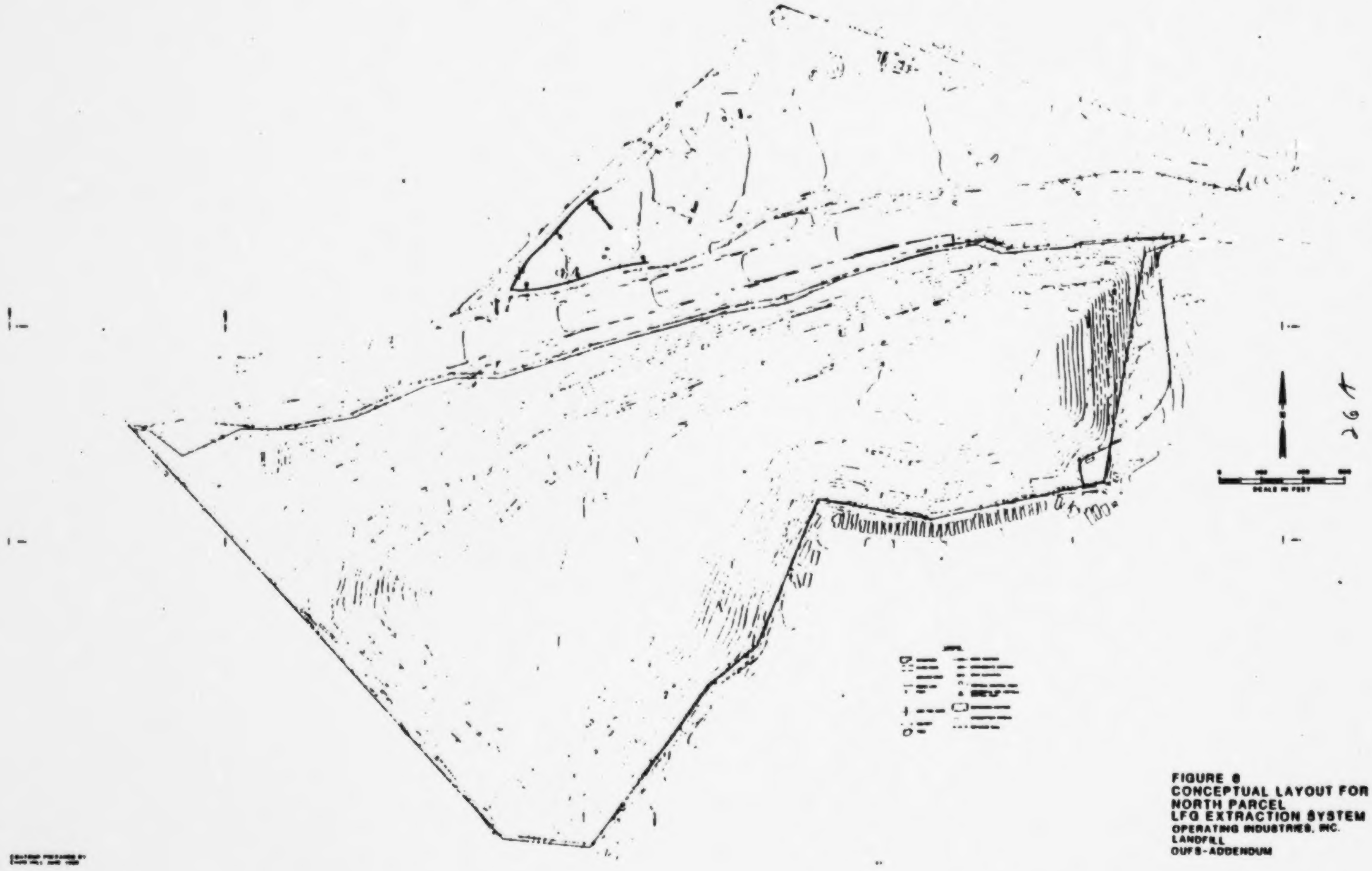
- Installing 1,500 feet of header lines.

Table 4
COST SUMMARY OF ALTERNATIVE NO. 9
MODIFIED REPLACEMENT ALTERNATIVE WITH LFG FLARING

Cost Items	Short-Term Capital Costs ($1,000's)
LFG Gas Extraction System Improvements	
New Perimeter	$8,000
New Interior	7,300
LFG Destruction System	
Type-Flare	900
Ancillary Items	
Protective Equipment	686
Decontamination and Disposal	28
Startup	90
Health and Safety	1,134
Construction-Related Equipment	858
Bid Contingency (5%)	949
Scope Contingency (10%)	1,899
Permitting and Legal (5%)	1,092
Services During Construction (8%)	1,747
Engineering Design (9%)	2,221
TOTAL (Rounded)	$26,900

Cost Item	Long-Term O&M Costs ($1,000's)
New LFG System	$2,280
TOTAL (Rounded)	$2,300

Note: Order-of-magnitude level estimates (expected accuracy range of -30 to +50 percent) at annual operation and maintenance costs.



26A

FIGURE 8
CONCEPTUAL LAYOUT FOR
NORTH PARCEL
LFG EXTRACTION SYSTEM
OPERATING INDUSTRIES, INC.
LANDFILL
OUFS-ADDENDUM

LFG collected by this component will be fed to the flare system included in Alternative 9. The expected quantity of gas to be collected by the extraction system under this alternative may vary between 9,000 and 14,000 cubic feet of methane per day. The capital cost of this alternative is estimated at $400,000, and annual operations and maintenance is estimated at $38,000 as shown in Table 5 (estimates are -30% to +50%).

EMISSION ESTIMATES

The landfill gas disposal technologies used by the gas control alternatives all involve thermal destruction of the gas. In order to estimate potential emissions from the gas destruction technologies, a review of South Coast Air Quality Management District (SCAQMD) source test data was performed. This data was from actual emissions tests performed by SCAQMD on similar technologies (i.e., flares, boilers, etc.) used at other landfills in southern California. Estimates of emissions per million Btus of LFG destroyed by each technology were developed from this data base.

In addition, potential emissions from flares and various resource technologies were calculated using the maximum gas extraction rate of approximately 136 million Btus per hour. Flare and internal combustion engine emissions were estimated using the maximum emission factor, since the mean emissions factor developed from many nonhazardous waste landfills was not considered representative of the situation at OII.

All of the LFG destruction technologies are estimated to exceed SCAQMD's new source review requirements for carbon monoxide (550 pounds per day) and nitrogen oxides (100 pounds per day) at the maximum gas extraction rates using the maximum emission factor. Therefore, EPA may be required to either establish sufficient additional controls on the proposed landfill gas flares to achieve these requirements, or consider alternative gas incinerator designs which would allow further emissions controls.
This change constitutes a minor modification of the proposed remedy. Thermal destruction will still be utilized and this modification will not significantly affect the cost of the selected remedy. Additional control equipment for flare emissions could increase the cost of the flare facility by $1 million. Use of alternative incinerator designs may increase the remedy costs by $1 to $2 million. Since the cost of the proposed remedy was previously estimated at $73 million, with an accuracy range of -30% to +50%, the cost of the remedy is not significantly affected.

Table 5
COST SUMMARY OF ALTERNATIVE NO. 10
NORTH PARCEL SYSTEM

Cost Items	Short-Term Capital Costs ($1,000's)
LFG Gas Extraction System Improvements	
New Interior	$ 200
Ancillary Items	
Protective Equipment	30
Decontamination and Disposal	3
Startup	3
Health and Safety	2
Construction-Related Equipment	14
Bid Contingency (5%)	13
Scope Contingency (10%)	26
Permitting and Legal (5%)	15
Services During Construction (8%)	24
Engineering Design (9%)	30
TOTAL (Rounded)	$400

Cost Item	Long-Term O&M Costs ($1,000's)
New LFG System	$38
TOTAL (Rounded)	38

Note: Order-of-magnitude level estimates (expected accuracy range of -30 to +50 percent) at annual operation and maintenance costs.

If the emissions requirement for landfill gas destruction cannot practicably be achieved, EPA will invoke the waiver from these requirements under SARA, on the grounds that compliance with these requirements would cause more damage to human health and environment (by preventing collection and destruction of landfill gas at OII) than waiving them.

Initial EPA screening results indicate that exposure to the highest concentrations of pollutants would be expected within approximately 550 yards (one-half kilometer) from the site. Based on this initial screening, a location on the North Parcel farther away from nearby residents is considered to be the most suitable location for the LFG disposal equipment.

Additional modeling will be performed to account for the effects of local topography and meteorology on emissions from the LFG destruction equipment. Detailed modeling will be performed during the design phase to optimize disposal equipment placement. Source testing will be performed once a remedy is implemented in order to collect actual data on emissions and destruction efficiencies.

PHASING OF ALTERNATIVES

It is anticipated that the selected gas control remedy for the OII site will require a phased implementation in order to optimize protectiveness, implementability, cost-effectiveness, and consistency with the final remedy. A conceptual phased implementation approach is described below. Further consideration of the implementation strategy will be required during design and construction of the remedy, and may require modification of this conceptual approach.

PHASE 1A

- The purpose of Phase 1A is to implement perimeter migration control in the areas of highest priority (along the west, south and east boundaries of the South Parcel) to reduce the potential for explosive levels of methane gas to accumulate in nearby residential neighborhoods. This would be the initial phase of perimeter control in these areas, to be complemented by additional well installations, if necessary during Phase 2.

- The perimeter control system will be installed in areas accessible around the boundary of the site (this excludes most of the boundary along the Pomona freeway where no access road exists). The perimeter system will be designed and installed to be compatible with the final cover for the South Parcel.

- The perimeter system includes multiple completion gas wells (upper and lower screened intervals) and multi-depth gas monitoring probe installations. Extraction wells will be installed in the air dike area. Any potential benefits of using the air dike system in conjunction with the extraction wells will be explored.
- The flare station site will be prepared and a foundation constructed which will be adequate to handle the anticipated equipment needs of the entire gas remedy. Flares and hardware components to provide adequate capacity for the initial phase will be installed.
- Any existing systems included in the selected remedy would also be included in the implementation of Phase 1A.

PHASE 1B

- The purpose of this phase will be to increase the effectiveness of source control at the site. This increased source control may improve perimeter migration control, particularly in the deeper areas of gas migration, and reduce surface emissions.
- Additional interior source control wells will be installed on the top deck of the South Parcel. Installation will be designed to be compatible with the final cover for the South Parcel.

PHASE 2

- The purpose of this phase will be to improve gas control in the priority areas of the landfill perimeter. Cost-effectiveness will be optimized by limiting the number of wells installed during the initial phase, and following up with installation of additional wells only where required to achieve gas migration control during Phase 2.
- Installation of probes and wells in Phases 1A and 1B will also be phased. Additional gas wells and gas probes will be installed based on an evaluation of the effectiveness of the initial gas wells. These additional wells will be installed in areas where gas migration has not been controlled, and

where it is considered to be prudent and consistent with the final remedy to install these wells. Additional flares and hardware will be installed as necessary.

PHASE 3

- The purpose of this phase will be to increase control of areas of high surface emissions prior to placement of the final cover in order to reduce the potential for exposure to the LFG in the ambient air.

- A limited number of shallow slope wells will be installed in areas of particularly high surface emissions. These wells will be designed to be consistent with the final remedy for the site. A limited number of wells will be installed during this phase, since application of final cover should increase the effectiveness of individual wells. Additional flares and hardware will be installed at the flare station as necessary.

PHASE 4

- As the final cover (selected in a future ROD) is installed at the site, it will be integrated with the existing control systems. The perimeter wells will be installed along the boundary with the Pomona Freeway. Additional perimeter wells, slope wells (shallow and, if necessary, deep), and top deck wells will be installed to achieve the CWMB requirement of less than 5 percent methane at the perimeter, and the SCAQMD 1150.1 surface emissions requirements of less than 50 ppm total organic compounds averaged over the surface and less than 500 ppm methane at any point on the surface.

PHASE X

- Expand the systems if necessary to control toxic and carcinogenic compounds in the gas to health based levels. The purpose of this phase will be to provide additional LFG control in areas where levels of hazardous LFG constituents are still being emitted at concentrations that could cause significant impacts to the public health.

PHASE Y

- Install Alternative 10 on the north parcel, once it is determined that the north parcel waste mass will remain in place. This phase will allow integration of the gas control remedy for the north parcel with the south parcel control system.

The selected remedies described in this section are conceptual. Changes in the actual design and phasing approach may occur during design and construction. In addition, although analysis contained in the Feasibility Study and the Administrative Record indicated that resource recovery options were not expected to be cost-effective, EPA may decide to implement a resource recovery component if, in the future, it is determined to be cost-effective,and consistent with EPA's other decision making criteria.

STATUTORY DETERMINATIONS

Protection of Human Health and the Environment

The selected remedy will eliminate the risk of fire or explosion due to landfill gas accumulating offsite by controlling methane concentrations to less than 5 percent at the landfill boundary. Surface emissions and subsurface landfill gas migration will be reduced as will the potential for exposure to toxic and/or carcinogenic compounds contained in the landfill gas at OII. The landfill gas destruction facilities will be located and designed to provide adequate protection of human health and the environment from emissions which could be expected to occur. Monitoring of the selected remedy, once operational, will occur as part of operations and maintenance, the overall RI/FS, and/or 5-year remedy reviews, to ensure adequate protection of human health and environment.

Short-term risks associated with the remedy include risks posed by well installation, and operation and maintenance of the system, with the potential for exposure of workers to explosive levels of methane and high levels of toxic and/or carcinogenic compounds in the landfill gas. Landfill gas emissions from drilling activities should dissipate rapidly and are not expected to cause unacceptable short-term risks offsite. Health and safety activities will be conducted during construction, and operations and maintenance activities to ensure adequate protection of human health and environment. Other short-term risks during construction should be similar to those posed by most heavy construction projects. Construction activities will be conducted in accordance with applicable health and safety requirements.

Gas wells and probes will be designed to reduce the potential for cross-contamination of groundwater during construction and operation. Collection of leachate from saturated zones encountered by gas wells, and condensate collection from gas pipelines should reduce potential releases of contaminated liquids from the site.

The potential for landfill gas to contaminate groundwater will also be reduced by the increased gas collection afforded by the selected remedy.

No unacceptable short-term risks or cross-media impacts will be caused by implementation of the remedy.

Attainment of ARARs

The selected remedy will be designed to attain the following applicable regulations unless otherwise noted. ARARs were identified from Federal, as well as more stringent promulgated State environmental and public health laws.

Federal regulations apply to the leachate and condensate that will be collected from the gas control system. These liquids will be treated to the POTW pretreatment requirements in compliance with the Clean Water Act at an onsite treatment facility constructed under EPA's Leachate Management Remedial Action. Prior to the treatment plant construction these liquids will be transported to an offsite treatment facility in compliance with the Department of Transportation (DOT) Rules for the Transportation of Hazardous Materials, and in compliance with EPA's offsite disposal policy.

The State of California has the following ARARs which are enforced by various agencies:

1. Hazardous Waste Control Law (Administered by CA DOHS under Title 22, Division 4, Chapter 30) - The hazardous waste management requirements of this law are applicable and will be attained. The closure and post closure requirements will not be attained by this operable unit. A waiver is being invoked for this operable unit since closure and post closure requirements will be addressed by subsequent remedial actions at the site.

2. Solid Waste Management and Resource Recovery Act of 1972 (Administered by the California Waste Management Board and Los Angeles DOHS under Title 14, Division 7) - Requirements for monitoring and reporting for landfill gas migration, and migration control under Title 14, Section 17705 - Gas Control are applicable. A waiver is being invoked for the Title 14 closure and post closure requirements since they will be addressed by subsequent remedial actions at the site.

3. California Air Pollution Control Regulations - Ambient Air Quality Standards for Hazardous Substances (Administered by California Air Resources Board under Title 17, Section 70200.5) - Applicable standard for ambient concentrations of vinyl chloride not to exceed 10 ppb over a 24-hour period.

4. South Coast Air Quality Management District Rules and Regulations (The California Air Resources Board delegates state authority to SCAQMD to enforce air quality in the local basin.)

Regulation IV - Prohibitory Rules

Rule 401 - Visible Emissions - Limits visible emissions from any point source to Ringleman No. 1 or 20 percent opacity for 3 minutes in any hour.

Rule 402 - Nuisance - This rule prohibits the discharge of any material (including odorous compounds) that cause injury, detriment, nuisance, or annoyance to the public, businesses, or property or endangers human health, comfort, repose, or safety. The selected remedy will require application of the final cover in order to adequately control odors at the site. Therefore a waiver is invoked for this ARAR since it will be addressed in subsequent remedial actions.

Rule 403 - Fugitive Dust - This rule limits onsite activities such that concentrations of fugitive dust at the property line shall not be visible and the downwind particulate concentrations shall not exceed 100 micrograms per cubic meter above upwind concentrations.

Rule 404 - Particulate Matter - This rule limits particulate emissions to a range of 0.010 to 0.196 grain per standard cubic foot depending on the volume of total stack gases.

Rule 407 - Liquid and Gaseous Air Contaminants - This rule limits carbon monoxide emissions to 2,000 ppm and sulfur dioxide emissions to 500 ppm. The sulfur dioxide limit does not apply if the fuel meets the provisions of Rule 431.1.

Rule 409 - Combustion Contaminants - This rule limits the emission of combustion contaminants to 0.10 grain per standard cubic foot at 12 percent carbon dioxide.

Rule 431.1 - Sulfur Content of Gaseous Fuels - This rule limits burning of fuel gas that has greater than 800 ppm hydrogen sulfide unless stack gases are cleaned to below the equivalent concentration.

Regulation XI - Source Specific Standards

Rule 1150.1 - Control of Gaseous Emissions from Active Landfills - This rule requires installation of a landfill gas control system and combustion, treatment and sale, or other equivalent method of landfill gas disposal. The rule requires perimeter landfill gas monitoring probes to evaluate offsite migration. It also limits concentrations of total organic compounds to 50 ppm over a certain area of the landfill, and limits maximum concentration of organic compounds (measured as methane) to 500 ppm at any point on the surface of the landfill. A final cover will be required to comply with this Rule and, therefore, a waiver is invoked for this operable unit because subsequent remedial actions will attain this ARAR.

Regulation XIII - New Source Review

Regulation 13 requires that whenever a permit is required for a new piece of equipment or modification to an existing piece of equipment at a facility or a site, that emissions be controlled using best available control technology (BACT) and that emissions be offset by other emissions reductions at the same facility or other nearby facilities. BACT is a series of emissions limits, process, and equipment specific requirements [see definition at 1301(e)]. The SIP is reviewed by the State Air Resources Board and the EPA for compliance under the Federal Clean Air Act. The net allowable cumulative increase in emissions are detailed in SCAQMD Rule 1303 and 1306.

Under SCAQMD Rule 1304(b)(2), there is an exemption from the offset requirements at 1303(b)(2)(C) for a landfill gas control or processing facility. The exemption waives the requirement to find enough criteria emissions offsets if the owner or applicant for the permit has: (1) provided all required offsets available by modifying sources owned; or (2) demonstrated to the satisfaction of the SCAQMD Executive Officer that the owner or applicant neither owns, nor operates other facilities within the district that could be modified to provide such offsets.

The State Implementation Plan (SIP) is reviewed by the State Air Resources Board and the EPA for compliance under the Federal Clean Air Act. However, EPA has not approved the exemption from the offset requirement, nor is such an exemption approvable as part of the SIP (40 CFR 51.165). Therefore, the offset requirement as contained in the SIP applies.

Moreover, on August 31, 1988, a moratorium on construction or modification of major stationary sources of carbon monoxide and volatile organic compounds went into effect (53 FR 1780; 40 CFR 52.24). A major source is defined as one which emits or has the potential to emit in excess of 100 tons per year of a specified pollutant. Flares may be considered to have the potential to emit in excess of 100 tons of CO per year.

Additional ARARs for Resource Recovery Equipment

1. SCAQMD Regulation IV - Prohibitory Rules

Rule 474 - Fuel-Burning Equipment Oxides of Nitrogen - This rule limits the concentration of oxides of nitrogen to a range of 125 to 300 ppm for gaseous fuels depending on maximum gross heat input.

Rule 476 - This rule applies to boilers larger than 50 million BTU per hour. Oxides of nitrogen may not exceed 125 ppm, combustion contaminants may not exceed 11 pounds per hour and 0.01 grains per standard cubic foot.

Future ARARs

Because of the failure of the South Coast Air Basin to attain the ozone and carbon monoxide standard by the statutory deadline, EPA has been required by the courts to promulgate a Federal Implementation Plan (FIP) which would expeditiously achieve those standards. Since EPA has not yet proposed a FIP, no FIP requirements apply to the OII gas control remedial action at the present time. However, EPA may promulgate a final FIP within one year. The FIP will likely contain additional stringent requirements for new and existing sources. Some of these requirements may apply to the OII gas control remedial action. Also, such requirements may constitute ARARs at the time of the 5-year review, and may necessitate further controls.

Cost-Effectiveness

The selected remedy affords overall effectiveness proportional to its cost such that the remedy represents a reasonable value for the money. When the relationship between cost and overall effectiveness of the selected remedy is viewed in light of the relationship between cost and overall effectiveness afforded by the other alternatives, the selected remedy appears to be cost-effective. The selected remedy provides protection of public health and environment that exceeds that of Alternatives 0 through 4, and is equivalent to the protection offered by Alternatives 5 through 8 (when integrated with Alternative 10). The two resource recovery alternatives (6 and 8) were found not to be cost-effective. The benefit to cost ratios for these two alternatives were less than one, indicating that the net costs of implementation and operation and maintenance would be increased rather than reduced by these alternatives. The 30 year present worth costs of Alternatives 5 and 7 (combined with Alternative 10 to provide similar degrees of protection) are estimated at $91 million and $97 million respectively compared to $73 million for the selected remedy. The estimated present worth cost of the selected remedy is equivalent to the estimated present worth cost of Alternative 4 combined with Alternative 10, which provides less control of subsurface gas migration and surface emissions (with the potential for explosive levels of landfill gas to continue migrating offsite) than the selected remedy.

Utilization of Permanent Solutions and Alternative Treatment (or Resource Recovery) Technologies to the Maximum Extent Practicable

The selected remedy utilizes permanent solutions and treatment or resource recovery technologies to the maximum extent practicable. The landfill gas which is collected by the selected remedy will be incinerated in flares. The flares or other gas incinerators represent a permanent solution for landfill gas destruction because the methane is burned and over 99 percent of the hazardous constituents in the gas stream are destroyed. Most of the remaining emissions from the flares are susceptible to ultraviolet degradation.

Several resource recovery options were evaluated in the Feasibility Study, however, it was determined not to be practicable to implement resource recovery technologies at this time. Resource recovery was determined not to be practicable due to the local utility company's (Southern California Edison) electrical capacity surplus, and the low anticipated electrical buy-back rates during the life of a resource recovery project. Other resource recovery technologies which did not involve electrical generation were also evaluated in the FS but were found not to be practicable due to high cost, technical feasibility, market considerations, etc.

If, in the future, the situation changes and resource recovery becomes a viable option at the site, the EPA will reconsider implementing a resource recovery component.

Preference for Treatment as a Principal Element

The selected remedy satisfies the preference for treatment to address principal threats posed by the site (within the scope of the operable unit). It is estimated that 90 percent of the methane gas produced at the site (as well as the associated toxic and carcinogenic compounds contained in the gas stream) will be collected by the selected remedy. This represents a 78 percent reduction in the volume of methane gas currently escaping from the site. The gas will be incinerated using landfill gas flares or other incinerators which have a destruction efficiency of over 99 percent for most of the hazardous compounds in the landfill gas. In addition, leachate and condensate (hazardous liquids) collected by the gas control system will be treated under EPA's Leachate Management Remedial Action. Therefore, the selected remedy will reduce the toxicity, mobility, and volume of the landfill gas, leachate, and condensate through the use of extraction, collection, and treatment.

Additional information concerning EPA's remedy selection criteria is included in the Summary of Comparative Analysis of Alternatives Section of this ROD, and in the OUFS, and the Administrative Record.

PERFORMANCE OF REMEDIAL RESPONSE ACTIVITIES AT UNCONTROLLED HAZARDOUS WASTE SITES (REM II)

LEACHATE MANAGEMENT FEASIBILITY STUDY OPERATING INDUSTRIES, INC. LANDFILL SITE

MONTEREY PARK, CALIFORNIA

December 30, 1987

U.S. EPA Contract No.: 68-01-6939
EPA Work Assignment No.: 21-9L58
REM II Document No.: 120-RI2-RT-FQJD-1

Prepared by:

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TABLE OF CONTENTS

SECTION PAGE

EXECUTIVE SUMMARY ES-1

1.0 INTRODUCTION 1-1

1.1 SITE LOCATION AND BACKGROUND 1-2

1.2 WASTE TYPES 1-6

1.3 NATURE AND EXTENT OF LEACHATE PROBLEM 1-6

1.3.1 Leachate Seepage/Migration 1-6
1.3.2 Leachate Control 1-11
1.3.3 Leachate Volume 1-14

1.4 LEACHATE CHARACTERIZATION 1-17

1.5 OBJECTIVES OF INTERIM REMEDIAL ACTIONS 1-21

2.0 DEVELOPMENT OF REMEDIAL ACTION ALTERNATIVES 2-1

2.1 GENERAL RESPONSE ACTIONS IDENTIFICATION 2-1

2.2 IDENTIFICATION OF REMEDIAL TECHNOLOGIES 2-1

2.2.1 On-Site Treatment 2-1
2.2.2 On-Site Disposal 2-4
2.2.3 Off-Site Treatment 2-5
2.2.4 Off-Site Disposal 2-6

2.3 DEVELOPMENT OF REMEDIAL ALTERNATIVES 2-6

2.4 IDENTIFICATION OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs) 2-7

2.4.1 Federal ARARs 2-7
2.4.2 State ARARs 2-8
2.4.3 Permits 2-10

2.5 IDENTIFICATION OF REMEDIAL ALTERNATIVES 2-10

TABLE OF CONTENTS
(continued)

SECTION PAGE

3.0 INITIAL SCREENING OF REMEDIAL ACTION ALTERNATIVES 3-1

3.1 CRITERIA FOR INITIAL SCREENING OF REMEDIAL ACTION ALTERNATIVES 3-1

3.2 INITIAL SCREENING OF REMEDIAL ACTION ALTERNATIVES 3-2

3.2.1 No Action/Endangerment Assessment 3-2
3.2.2 Off-Site Treatment 3-42
3.2.3 Off-Site Disposal 3-45
3.2.4 On-Site Disposal 3-47
3.2.5 On-Site Treatment 3-48
3.2.6 Summary of Alternative Screening 3-54

4.0 DETAILED ANALYSIS OF SELECTED REMEDIAL ACTION ALTERNATIVES 4-1

4.1 OFF-SITE TREATMENT OF LEACHATE 4-2

4.1.1 Technical Discussion of Off-Site Treatment 4-2
4.1.2 Safety and Public Health Protection 4-5
4.1.3 Institutional Requirements 4-6
4.1.4 Environmental Impacts 4-7
4.1.5 Alternate Off-Site Treatement at Oil Process Company 4-8

4.2 ON-SITE TREATMENT OF LEACHATE 4-8

4.2.1 Technical Discussion of On-Site Treatment 4-8
4.2.2 Safety and Public Health Protection 4-27
4.2.3 Institutional Requirements 4-32
4.2.4 Environmental Impacts 4-36

4.3 EVALUATION OF ALTERNATIVES BASED ON COST 4-37

4.3.1 Capital Cost Estimates 4-38
4.3.2 Annual Operation and Maintenance Cost 4-41
4.3.3 Present Worth Analysis 4-42

5.0 SUMMARY OF ALTERNATIVES 5-1

TABLE OF CONTENTS
(continued)

REFERENCES

APPENDIX A: ORGANIZATIONS AND INDIVIDUALS CONTACTED

APPENDIX B: HISTORICAL BACKGROUND OF OPERATING INDUSTRIES, INC.

APPENDIX C: OII LANDFILL SITE LEACHATE ANALYSES (1983-1986)

APPENDIX D: ON-SITE TREATMENT PLANT CONFIGURATION - ALTERNATIVE 5

APPENDIX E: OII LEACHATE JAR TESTS

APPENDIX F: REMEDIAL ACTION ALTERNATIVE COST ESTIMATES

APPENDIX G: SITING CONSIDERATION AND COST ANALYSIS OF THE ON-SITE TREATMENT FACILITY

APPENDIX H: MONTEREY PARK RESOLUTIONS 60-58

LIST OF TABLES

TABLE PAGE

1 Summary of Initial Screening of Alternatives ES-5

2 Leachate Treatment Alternative Summary ES-6

1-1 Waste Quantities 1-7

1-2 Generic Liquid Waste Types Disposed at OII (1976-1984) 1-8

2-1 Treatment Technologies 2-4

2-2 Effluent Discharge Limits 2-11

3-1 Representative Chemicals of Concern 3-11

3-2 Classification of PAHs According to Evidence for Carcinogenicity 3-29

3-3 Potential Applicable or Relevant and Appropriate Requirements 3-38

3-4 Summary of Initial Screening of Alternatives 3-54

4-1 Air Stripping Design 4-21

4-2 Screening Risk Analysis 4-30

4-3 Estimated Capital Costs 4-40

4-4 Estimated Annual Costs 4-43

4-5 Present Worth Analysis 4-44

5-1a,b Summary of Alternatives 5-4,5

TABLE OF CONTENTS
(continued)

LIST OF FIGURES

FIGURE PAGE

ES-1 Location Map ES-2

1-1 Location Map 1-3

1-2 Landfill Area Permitted for Liquid Waste Disposal 1-5

1-3 Areas of Leachate Seeps 1-10

1-4 Leachate Collection System 1-12

1-5 Record of Leachate Pumped 1-15

4-1 ChemTech Leachate Treatment Process 4-3

4-2 Alternative 2 Treatment Plant Process Train 4-10

4-3 Alternative 3 Treatment Plant Process Train 4-12

4-4 Alternative 5 Treatment Plant Process Train Preliminary 4-13

4-5 Alternative 6 Treatment Plant Process Train 4-14

4-6 On-Site Treatment Plant Layout General Layout 4-16

G-1 On-Site Treatment Facility Alternative Locations G-2

EXECUTIVE SUMMARY

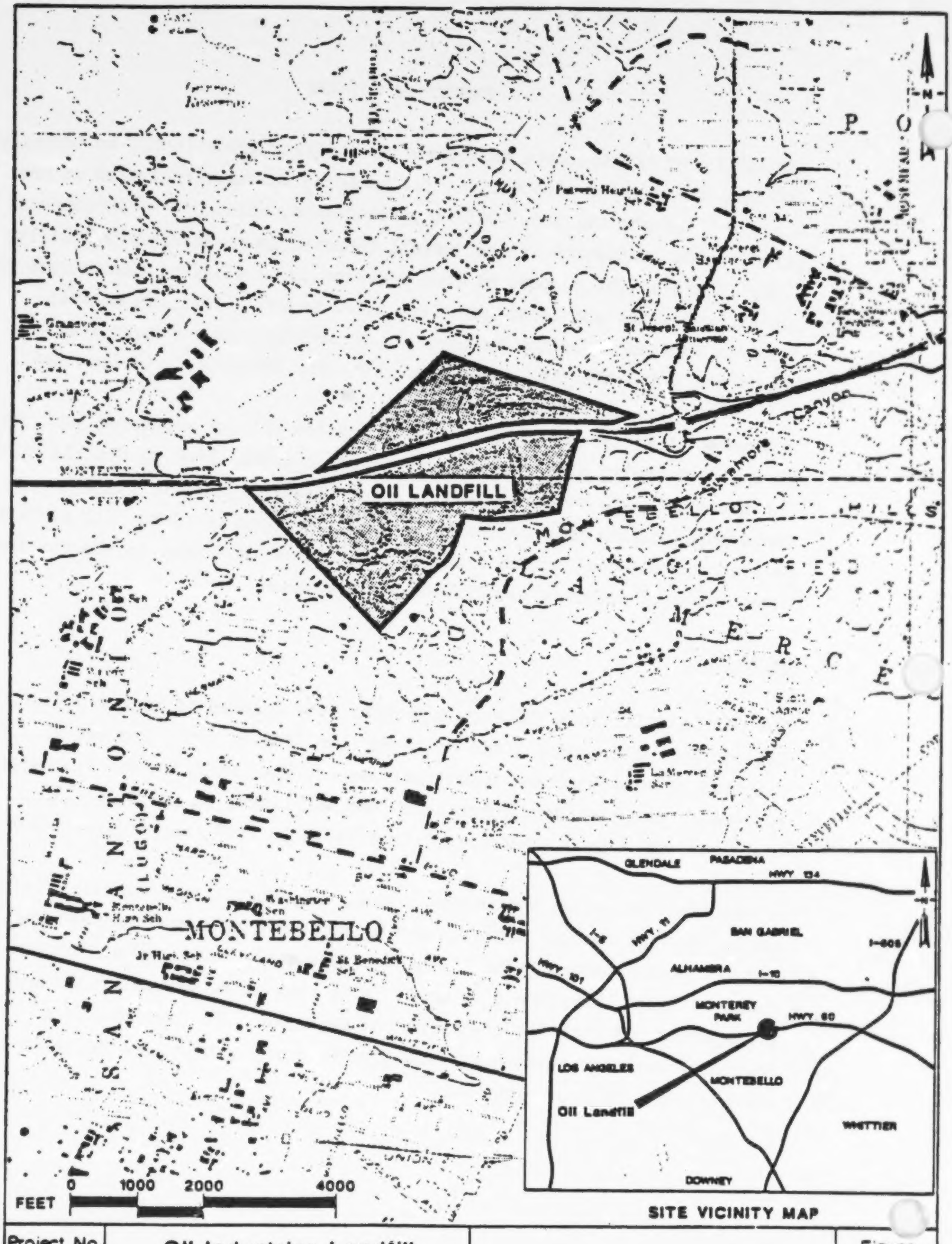
EPA conducted the Leachate Management Feasibility Study (LMFS) to identify and evaluate various alternatives for managing leachate collected at the Operating Industries, Inc. (OII) Superfund site, which can be implemented prior to the completion of the overall Remedial Investigation/Feasibility Study (RI/FS). The purpose of this document is to elicit comments from the public, and state and local agencies, prior to EPA's decision on what leachate management action to take. This decision will address leachate management until the final remedial action for the site is implemented.

Improvements to the leachate collection system will be addressed separately through continuing site control activities, and the on-going overall RI/FS for the site. The overall RI/FS will take several years to complete and implement. During this period, site conditions and problems will be better defined and remedial action alternatives will be developed to address the broad range of problems associated with the site.

Background

The OII landfill is a 190-acre Superfund site located in Monterey Park, California. The landfill was operated from 1948 to 1984, and was used for disposal of municipal and industrial waste. The landfill contains hazardous wastes and hazardous substances, and was listed on the National Priorities List (NPL) as a CERCLA (Superfund) site in 1986 (see Figure ES-1).

A leachate collection system was installed by Operating Industries in the early 1980s to control off-site and on-site surface seeps and has subsequently been expanded. The leachate is presently collected and stored in tanks ("Baker" tanks) on-site until it is removed by vacuum trucks and transported off-site for treatment and sewering. The leachate is a hazardous waste containing oil and grease, heavy metals, and volatile and semi-volatile organic compounds.


OII LANDFILL
MONTEBELLO
MONTEBELLO HILLS
Potrero Heights
Canyon
Montebello High Sch
Jr High Sch
St Benedict Sch
FEET
0
1000
2000
4000
GLENDALE
PASADENA
HWY 134
SAN GABRIEL
I-605
I-5
HWY 11
HWY 101
ALHAMBRA
I-10
MONTEREY PARK
HWY 60
LOS ANGELES
MONTEBELLO
OII Landfill
WHITTIER
DOWNEY
SITE VICINITY MAP
N
DATAPRINT

Project No.	OII Industries Landfill	LOCATION MAP	Figure
120-RI2	Camp Dresser & McKee Inc.		ES-1

Overview of the Feasibility Study

Identification of Response Actions and Technologies:

General types of remedial actions were identified from which alternatives for managing the leachate could be developed. On-site treatment, off-site treatment, on-site disposal, and off-site disposal were all considered potential actions for management of leachate collected at the site. Technologies for each type of action were screened to determine which would be effective for the specific conditions present at the OII site. Those that were considered technically feasible were developed into remedial technologies for further screening and evaluation. A "no action" alternative was considered as a baseline against which other alternatives could be compared.

Four types of on-site treatment technologies were considered. Incineration and biological treatment were eliminated from further evaluation due to technical considerations. Chemical and physical treatment technologies were identified which would be effective for treating the OII leachate. Six treatment processes were developed from these technologies which provided varying degrees of treatment and emissions control. These processes were further screened and evaluated in the study.

Two on-site disposal technologies were identified; land application, and evaporation in lined ponds. Land application (recycling of the leachate) was eliminated from further consideration based on technical concerns. Evaporation in lined ponds was further screened and evaluated in the study.

Both off-site treatment, and off-site disposal (without treatment) were considered further. No action was also considered further to provide a baseline for comparison of the other alternatives.

Initial Screening

The technologies were assembled as alternatives to be screened and evaluated. The alternatives included:

- on-site treatment
  - six on-site treatment processes;
- on-site disposal (without treatment)
  - evaporation in lined ponds
- off-site treatment
  - leachate trucked to off-site treatment facility;
- off-site disposal (without treatment)
  - leachate trucked to off-site disposal facility;
- no action
  - no operation of the leachate collection system, no removal of leachate from the collection tanks.

These alternatives were screened based on the effectiveness of protection of public health and environment, and on cost. Based on this initial screening, five alternatives were eliminated. Two on-site treatment processes, on-site disposal, and no action were eliminated due to public health and environmental concerns. Off-site disposal was eliminated due to public health and environmental concerns, as well as cost. A summary of the results of the initial screening of alternatives is presented in Table 1.

Detailed Evaluation

Only off-site treatment, and on-site treatment were evaluated further. Off-site treatment and the four on-site treatment processes were evaluated in detail, based on technical feasibility, institutional and public health requirements, and environmental impacts. A detailed cost analysis was also conducted. The present worth costs of the alternatives were compared at discount rates of 6% and 8% over operational periods of five years and thirty years. A five-year period was chosen to assure consistency with the final remedy, expected to be implemented in approximately five years. A summary of the results of this detailed evaluation, using a discount rate of 6% is presented in Table 2.

TABLE 1

SUMMARY OF INITIAL SCREENING OF ALTERNATIVES

Alternative	Results of Initial Screening	Reason for Elimination
No Action	Eliminated	Potential adverse public health and environmental effects
Off-site treatment	Consider further	———
Off-site disposal	Eliminated	Potential adverse public health effects, EPA policy, permanency, cost
On-site disposal	Eliminated	Potential adverse public health effects, permanency
On-site treatment		
Alt.1 - Gravity separation sewer disposal	Eliminated	Potential adverse health and environmental effects, permanency
Alt.2 - Gravity separation, coagulation addition, DAF, filtration, air stripping with off-gas treatment sewer disposal	Consider further	———
Alt.3 - Same as Alt.2 with GAC replacing air stripping/off-gas treatment	Consider further	———
Alt.4 - Same as Alt.3 with air stripping without off-gas treatment added prior to GAC	Eliminated	Potential adverse health effects, permanency
Alt.5 - Same as Alt.4 with off-gas treatment added	Consider further	———
Alt.6 - Same as Alt.5 with UF/RO added and reuse of effluent	Consider further	———

TABLE 2 - EXECUTIVE SUMMARY

INTERIM LEACHATE TREATMENT ALTERNATIVE SUMMARY FOR THE OII LANDFILL SITE - SITE B

ALTERNATIVE	COST ($1,000) CAPITAL 5 YR	PRESENT WORTH @ 6% 5 YR	30 YR	PUBLIC HEALTH CONCERNS	ENVIRONMENTAL CONCERNS	TECHNICAL CONCERNS	COMMUNITY RESPONSE CONCERNS	INSTITUTIONAL CONCERNS
NO ACTION	---	---	---	Unacceptable exposure to leachate migrating off-site. Potential health risks due to leachate exposure.	Potential for widespread environmental contamination.	---	Unacceptable	Does not meet ARARs.
OFF-SITE TREATMENT	30	6,808	22,179	Potential for human exposure due to spillage of leachate during loading, unloading, transport and treatment. Exposure to air emissions.	Potential for surface and groundwater contamination due to spillage during transport.	Reliability	Acceptable	Meets ARARs if facility operated in compliance. No control over compliance.
ON-SITE TREATMENT								
2) Chemical add., DAF, filtration, air stripping	1,862	4,212	9,922	Potential for spills during treatment, however, spills would be fully contained at the facility.	Minimal effects during construction.	May not remove organics to an acceptable level.	Plant location, aesthetic impact, noise, odors, safety.	May not meet ARARs. May not receive approval for discharge.
3) Chemical add., DAF, filtration, carbon adsorption	1,876	5,164	13,000	Potential for spills during treatment, however, spills would be fully contained at the facility.	Minimal effects during construction.	Less efficient performance without air stripping.	Plant location, aesthetic impact, noise, odors, safety.	Meets ARARs.
5) Chemical add., DAF, filtration, air stripping, carbon adsorption	1,975	4,947	12,067	Potential for spills during treatment, however, spills would be fully contained at the facility.	Minimal effects during construction.	None	Plant location, aesthetic impact, noise, odors, safety.	Meets ARARs.
6) Chemical add., DAF filtration, air stripping, carbon adsorption, U.F., R.O.	2,297	5,427	12,904	Potential for spills during treatment, however, spills would be fully contained at the facility.	Minimal effects during construction.	Possible membrane fouling problems. Low permeate recovery rate. Brine disposal.	Plant location, aesthetic impact, noise, odors, safety.	Exceeds ARARs for sewer disposal. May have difficulty attaining reuse standards.

--- = not applicable

Preferred Alternative

On-site treatment is EPA's preferred alternative. This alternative, unlike off-site trucking of untreated leachate, reduces potential health and environmental impacts which could be caused by a truck accident, or a spill at the point of loading or unloading. Operation of an on-site treatment plant would be more reliable due to EPA control of all phases of the treatment process from leachate storage on-site, to control of the treatment process, and storage and testing of treated water prior to discharge. EPA control of treatment plant design would enable construction of a treatment plant with safety features to prevent and contain potential spills, and control emissions from the plant to prevent odors and reduce noise.

In addition to the public health and environment, and reliability considerations, on-site treatment is also the least costly alternative. EPA has no control over off-site treatment costs, and if rates were to increase, off-site treatment would become even more costly. In addition, if EPA chose an off-site treatment plant which was to go out of business, or had a significant violation of regulations, EPA would be forced to look for a different leachate management alternative.

EPA identified four potential sites for on-site treatment facilities, which are presented in Appendix G. An additional site was also identified based on discussions with representatives of Monterey Park and Montebello. This site is also identified in Appendix G. Although specific cost estimates were not prepared for this site, it is anticipated that plant costs would be similar to those for other sites.

EPA released the draft Leachate Management Feasibility Study in March 1987 for public comment. The initial comment period was held from March 9 to April 13, 1987. In order to make sure that adequate review time was provided, EPA reopened and extended the public comment period through May 11, 1987. A responsiveness summary was prepared to accompany the Record of Decision consisting of a review and summary of the comments received on the Feasibility Study and including EPA's responses to these comments.

1.0 INTRODUCTION

EPA is conducting this study to identify response actions and develop and evaluate alternatives for managing leachate collected at the Operating Industries, Inc. (OII) landfill site, which can be implemented prior to the completion of the overall Remedial Investigation/Feasibility Study (RI/FS). By addressing leachate management separately from the overall RI/FS, this study will enable the EPA to identify the best alternative for managing the leachate until the RI/FS is completed. The leachate is a hazardous waste.

The overall RI/FS will take several years to complete and implement. During this period, site conditions and problems will be better defined, and remedial action alternatives will be developed to address the broad range of problems associated with the site. The leachate management alternative which is selected from this study must be consistent with the remedial action which will be identified in the overall RI/FS. To assure this consistency, alternatives selected from this study should not prevent implementation of a future remedial action, and will have the potential to be incorporated in a future remedial action.

This study will assess the feasibility of leachate management alternatives using the criteria of adequacy of protection of public health, welfare and the environment; cost effectiveness; and consistency with the final site remedy. Federal and state applicable or relevant and appropriate requirements (ARARs) will be identified and used in the formulation and screening of alternatives.

Improvements to the leachate collection system are not addressed in this study, but will be addressed separately through continuing site control activities, and the overall RI/FS for the site. Site control improvements to the collection system will be implemented prior to the conclusion of the overall RI/FS.

The feasibility study has been prepared in accordance with the provisions of the Superfund Amendments and Reauthorization Act of 1986, the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) (42 U.S.C.960.1, et seq.) and the National Contingency Plan (NCP). The U.S. Environmental Protection Agency's (EPA) document Guidance on Feasibility Studies Under CERCLA has also been followed.

Data and information used in preparing the feasibility study were obtained from the following sources:

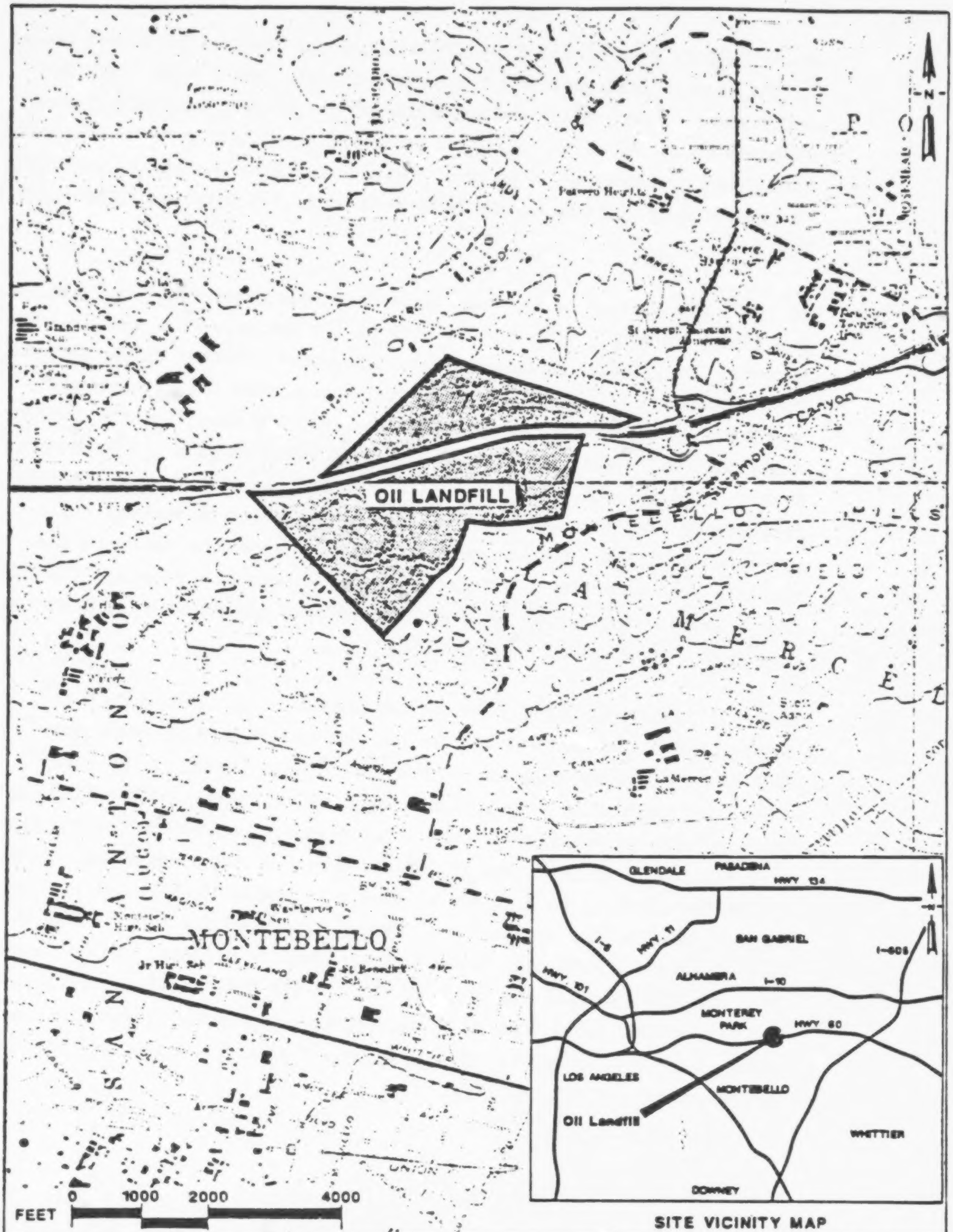
- Initial Remedial Measures for the Operating Industries, Inc. Site, RI/FS, November 11, 1985, Woodward-Clyde;
- Leachate bench-scale treatability studies performed by Camp Dresser & McKee Inc., 1986 (Appendix E);
- Operating Industries, Inc. Landfill Site Closure Plan (draft), October 1983, Lockman & Associates;
- Analysis of the OII leachate from 1983 to 1986 (Appendix C): and
- Interview and discussions with individuals knowledgeable about the landfill's operations (listed in Appendix A).

1.1 SITE LOCATION AND BACKGROUND

The OII Landfill is a 190-acre facility located at 900 Potrero Grande Drive, Monterey Park (Los Angeles County), California as shown in Figure 1-1. California Highway 60 (Pomona Freeway), built in 1974, divides the site into a 45-acre north parcel and a 145-acre south parcel.

Prior to the use of the site as a landfill (1948) the area was being quarried for sands and gravels. From 1948 to 1952 the site was used primarily to dispose of municipal garbage. In 1952, the landfill site came under the ownership of the Monterey Park Disposal Company which later became OII. From 1952 to 1984 the site was operated as a trash dump and industrial waste landfill.

In 1975, the Monterey Park City Council limited disposal at the landfill to the area south of the Pomona Freeway. In 1976, the Los Angeles Regional

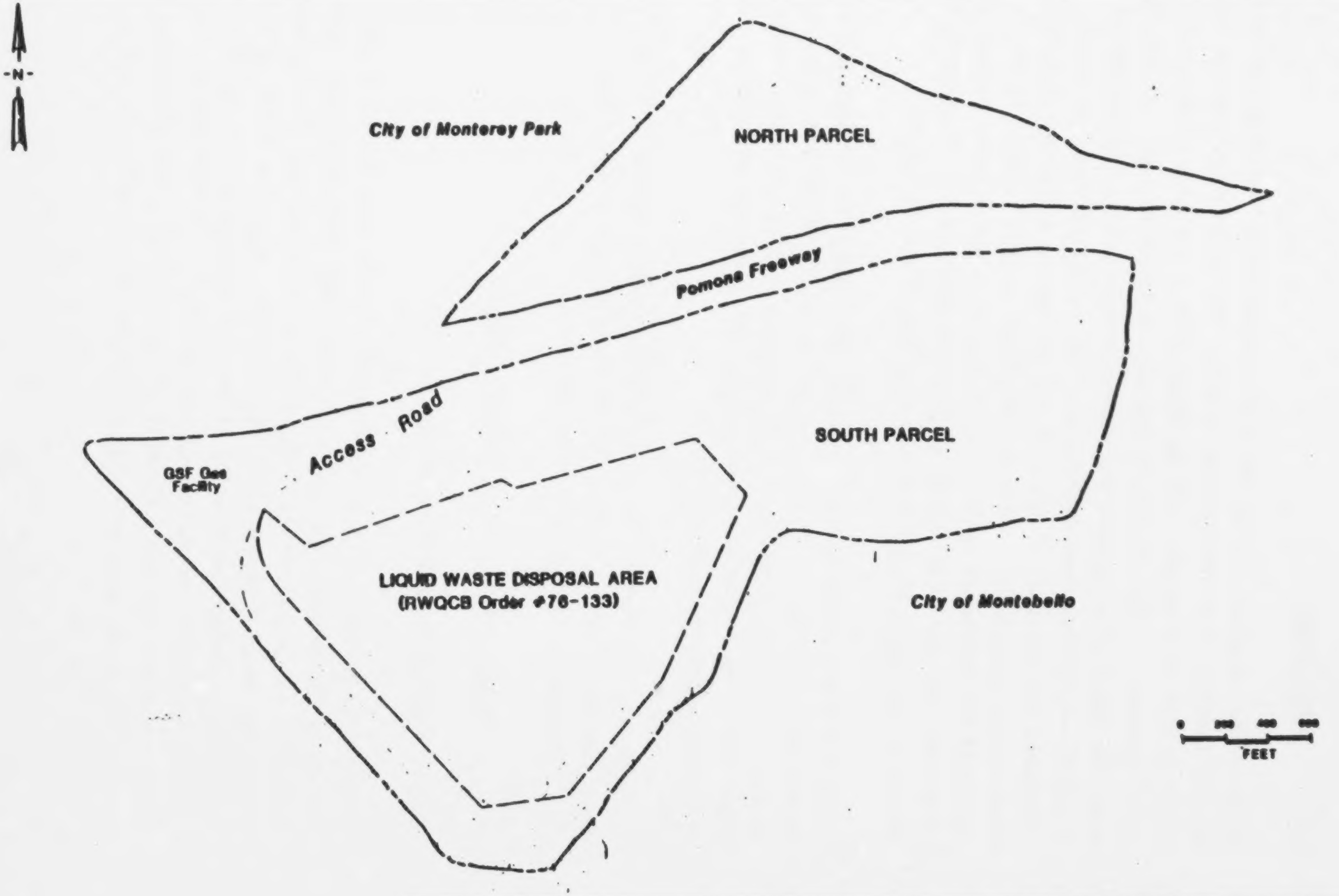

N
Potrero Heights Sch
Canyon
Sycamore
OII LANDFILL
MONTEBELLO HILLS
Montebello High Sch
MONTEBELLO
Jr High Sch
St Benedict Sch
Fire Station
FEET
0
1000
2000
4000
GLENDALE
PASADENA
HWY 134
SAN GABRIEL
I-605
I-5
HWY 11
HWY 101
ALHAMBRA
I-10
MONTEREY PARK
HWY 60
LOS ANGELES
MONTEBELLO
OII Landfill
WHITTIER
DOWNEY
SITE VICINITY MAP

Project No.	OII Industries Landfill	LOCATION MAP	Figure
120-RI2	Camp Dresser & McKee Inc.		1-1

Water Quality Control Board (RWQCB) limited the disposal of liquid wastes to the western most portion of the south parcel, (see Figure 1-2), and RWQCB required monitoring and reporting of all wastes, including liquids disposed of at the site. Prior to 1976, there was little or no monitoring, accounting or reporting required. The site contains wastes characterized as hazardous by the California Department of Health Services (DOHS) and the EPA.

In 1980, OII applied to the DOHS for a Hazardous Waste Facility Permit with the intent to comply with Section 3010 of the Resource Conservation and Recovery Act (RCRA). On December 18, 1981, DOHS granted OII an Interim Status Document (ISD). The interim status permitted OII to continue operating and receiving hazardous wastes. The ISD specified the requirements that OII would have to comply with in order to gain a RCRA Part B permit. Inspections conducted by the DOHS and the EPA during August and December of 1982 found the OII facility in violation of several ISD provisions. Rather than making the capital expenditures to bring the facility into full ISD compliance and to file an application for the RCRA Part B permit, in January of 1983, OII declared its plan to cease accepting hazardous liquid wastes for disposal.

Prior to January of 1983, problems had been developing at the site. Methane gas was migrating off site and leachate bleeds or seeps were observed at several locations on the face of the landfill. Of great concern to the public were leachate seeps migrating beyond the landfill boundary into adjacent properties. Furthermore, residential neighborhoods adjacent to the landfill had registered numerous odor complaints. Recognizing the landfill as a potential threat to public health, welfare, and the environment, the State of California placed the OII landfill on their list of Priority Hazardous Waste Sites in January of 1984. In October of 1984, the OII landfill was proposed for the EPA National Priority List (NPL) of uncontrolled hazardous waste sites. The OII site was officially added to the NPL in May of 1986. Appendix B contains a detailed historical background of the OII facility.



N
City of Monterey Park
NORTH PARCEL
Pomona Freeway
Access Road
GSF Gas Facility
SOUTH PARCEL
LIQUID WASTE DISPOSAL AREA
(RWQCB Order #76-133)
City of Montebello
0
FEET

Project No.	Oil Industries Landfill	LANDFILL AREA PERMITTED FOR LIQUID WASTE DISPOSAL	Figure
120-RI2	Camp Dresser & McKee Inc.		1-2

1.2 WASTE TYPES

Solid wastes, sludges, slurry and liquid wastes have been disposed of at the OII landfill site dating back to 1948. The south parcel was in continuous use from 1958 to 1984, and operated under a variance (Resolution 60-58, October 7, 1958) issued by the City of Monterey Park. In the variance, the types of acceptable and non-acceptable wastes and methods of disposal are defined (see Appendix H). The permitted types of waste acceptable for disposal at the site did not change during the remainder of land-filling operations. However, the RWQCB in 1976 (order #76-30) increased the allowable ratio of liquid waste to uncompacted rubbish from 10 gallons per cubic yard to 20 gallons per cubic yard. There is no information on the types of solid wastes disposed of in the landfill.

Table 1-1 shows annual waste quantities and average ratios reported monthly by OII to the RWQCB. During the reporting period of 1976-84, over 285 million gallons of liquid wastes were disposed of at the site. Table 1-2 shows the generic type of liquid wastes comprising the 285 million gallons and their approximate percentages.

In addition, many hazardous wastes may have been disposed of at OII that were improperly or not clearly described on the OII monthly reports, or were disposed of illegally without manifests.

1.3 NATURE AND EXTENT OF LEACHATE PROBLEM

1.3.1 LEACHATE SEEPAGE/MIGRATION

Leachate is a liquid that forms within landfills as a result of the following processes: (1) rainfall and drainage that percolates into the landfill; (2) liquid wastes disposed of in landfill; and (3) biodegradation of organic waste disposed of in the landfill. When the volume of leachate exceeds the absorption capacity of the dry solids and soil, it will accumulate in the voids and pockets of the landfill. Leachate tends to percolate downward within the landfill until relatively impervious layers are encountered. Hydraulic gradients can be produced which cause leachate to move

TABLE 1-1
WASTE QUANTITIES*

Date	Solids (tons)	Solids (volume, cu yd)	Liquid (volume, gal)	Gallons of Liquid per cu yd of solid waste
1976[1]	429,956	2,863,506	27,000,000	9.42
1977[2]	533,230	3,554,852	65,360,898	18.39
1978	524,415	3,401,575	60,919,152	17.91
1979	476,483	3,018,467	56,470,680	18.71
1980	419,587	2,797,640	42,607,320	15.23
1981	289,925	1,933,466	20,307,000	10.50
1982	Data not available			
1983[2]	264,127	1,760,453	9,186,711	5.21
1984[3]	133,821	892,140	3,767,400	4.22
			285,620,000	

[1] for 6.5 months
[2] for 11 months
[3] for 6 months

---

*Data from OII monthly reports to RWQCB

TABLE 1-2

GENERIC LIQUID WASTE TYPES DISPOSED OF AT OII FROM 1976-1984

(% figures are approximate values based on general descriptions appearing on OII monthly reports to the RWQCB)

Mud and water	60 %
Mud, water and oil	12 %
Drilling mud	4 %
Tank bottom	6 %
Latex wastes	2 %
Paint sluge	2 %
Coolant	1.5%
Carbon black and water	1 %
Remaining generic types	11.5%

Alkaline solution
Aluminum sludge and flocculent
Animal fat and water
Asbestos pulp and water
Asphalt and water
Brake fluid
Brine
Burnishing media
Burner (baghouse) dust
Carpet material and water
CAT CR catalyst
Caustic soda
Caustic solution
Cement and water
Ceramic glaze
Cleaning compound
Coconut
Corn syrup
Creosote
Dairy wastes
Diamogion silica
Dough and water
FCC fines and water
Fiber glass
Film gelatin
Filter clay
Fish and water
Food processing wastes
Glass dust and water
Glue and water
Grease waste and water
Ink and water
Lime and water
Lint and water
Liquor
Metal dust and water
Mineral water
Molasses and water
Nickel, copper and water
Oxides (Al, Pb, Si, Zr)
Organic waste
Perlite
Petroleum industry sludge
Plastic dust
Polymer sludge
Rain water
Resin, PVC and water
Rouge and water
Rust sludge
Sand and water
Sawdust and water
Settling basin sludge
Slurry
Soap and water
Sodium silicate
Starch and water
Stretford solution
Sulfur fines in water
Tank sludge
Tar pit sludge
Tile glaze
Waste paper
Waste water
Wax (polishing compound) and water
Welding flux

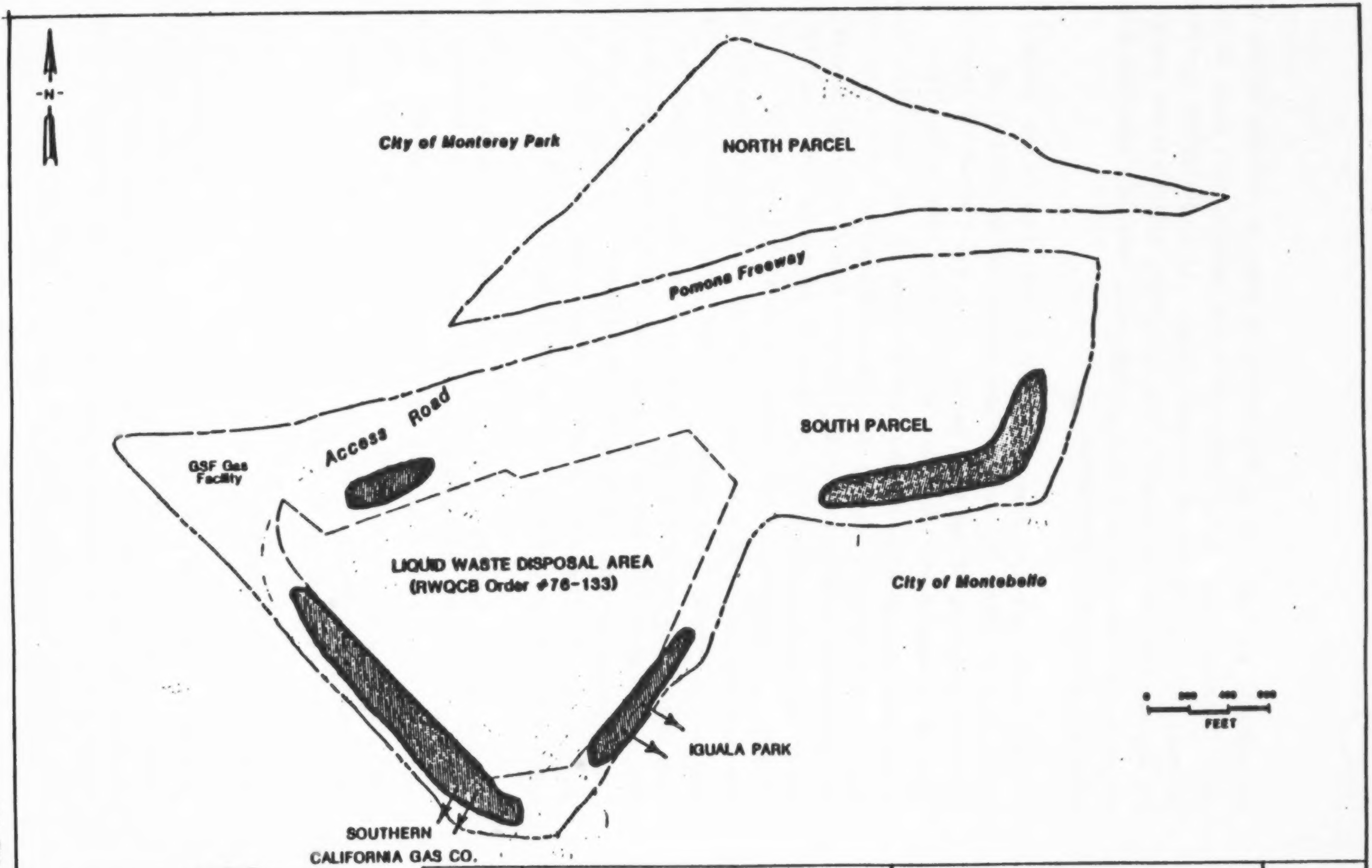
horizontally and appear as surface bleeds or seeps on the face of the landfill. Leachate seeps usually occur where the landfill soil cover is the thinnest, such as the toe of terraced slopes. If uncontrolled, the leachate may migrate from the landfill site as surface runoff (as the result of seeps) or percolate downward through underlying materials into saturated zones and contaminate groundwater.

Leachate seeps have been observed at several locations on the landfill dating back to 1982. The worst of the seepage has occurred in the southwest perimeter of the south parcel. Figure 1-3 shows the landfill areas where seepage has been observed. As can be seen in the figure, three of the four seepage areas are near the perimeter of the area where liquid wastes were disposed of during the 1976 to 1984 period. The arrows depict the approximate locations where liquids have been noted in properties beyond the landfill boundary. The seeps in the Iguala Park area have been of sufficient quantity to flow across the sidewalk adjacent to a park area and into the road. The liquid was thought to be leachate because it was observed to have an "oily sheen" and it discolored the sidewalk. Seeps were sampled and analyzed by the South Coast Air Quality Management District in March 1983 and by the Department of Health Services in October 1983. Various organic and inorganic constituents were identified which suggest that the liquid was leachate. These seeps, as they occur, will be sampled and analyzed as a part of the EPA's ongoing RI/FS.

The leachate seepage and off-site migration into adjacent properties is a major concern. The OII landfill leachate, as specified by RCRA and codified in the Federal Register (40 CFR 261.3), is a hazardous waste. As such, it poses a serious threat to public health and welfare and to the environment. Further discussion of the potential impacts are presented in the No Action/Endangerment Assessment section.

1.3.2 LEACHATE CONTROL

Action has been undertaken at the landfill to control and prevent leachate seeps from occurring. Construction of a leachate collection system by OII began in the early 1980s, in response to an order from the State of California. As the seepage problems worsened, OII was directed (AQMD


-N-
City of Monterey Park
NORTH PARCEL
Pomona Freeway
Access Road
GSF Gas Facility
SOUTH PARCEL
LIQUID WASTE DISPOSAL AREA
(RWQCB Order #76-133)
City of Montebello
IGUALA PARK
SOUTHERN
CALIFORNIA GAS CO.
0 200 400 800
FEET

LEGEND

▆ Areas of Leachate Seeps

← gration to Offsite Properties

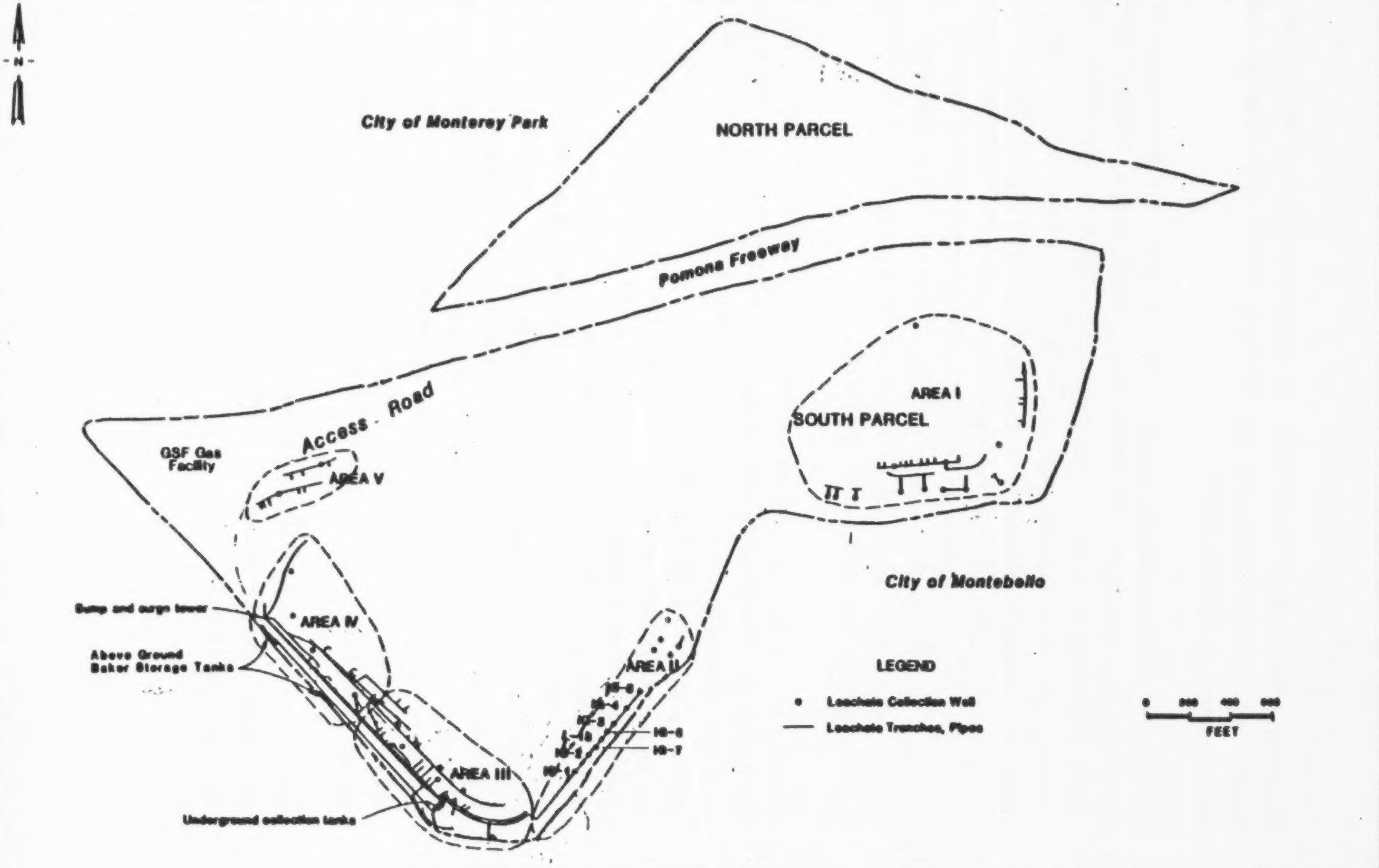
Project No.	Oil Industries Landfill	AREAS OF LEACHATE SEEPS	Figure
120-RI2	Camp Dre r & McKee Inc.		1-3

Abatement Order #2121-1, April 1983) to expand the existing collection system, and, wherever a new seep was observed, it was to be brought under control within a 48-hour period.

The present leachate control system at the OII site is a combination of french drains (trenches), collection wells, sumps, pumps, leachate lines, underground collection tanks, and above-ground Baker storage tanks. The existing leachate collection system can be divided into five different geographical areas. Referring to Figure 1-4, Area I on the southeast side of the site consists of trenches, perforated pipes and leachate disposal wells drilled into dry refuse. Liquid waste disposal was not legally permitted on this portion of the landfill. However, there have been leachate seeps. Since the installation of the Area I collection system no surface seepage has occurred in this area.

The Area II leachate collection system consists of the six Iguala wells. The Iguala wells were installed to prevent leachate seeps in the Iguala Park area southwest of the OII boundary. The wells are 70 to 80 feet deep, generally extending through approximately 10 to 15 feet of landfill rubbish and into native earth material. The wells were equipped with electrically powered submersible pumps. Leachate collected from the wells is pumped into a collection manifold pipe connecting the six wells to the underground tanks in leachate collection Area III. There are five other wells in Area II that are not connected to the collection system. In the past, leachate has been pumped from these wells into vacuum trucks. There is no record of pumping for the past several years. Two new collection wells have been installed as part of EPA's Expedited Response Actions for the site. These wells are part of the collection system installed to prevent seeps in the Iguala Park area, and are located 50 feet on either side of well #L-18.

Additionally, two gas extraction wells (3-7 and 3-9) have been outfitted with pumps and will be used as leachate extraction wells. The wells are northwest of Area II.


N
City of Monterey Park
NORTH PARCEL
Pomona Freeway
Access Road
GSF Gas Facility
AREA V
SOUTH PARCEL
AREA I
City of Montebello
AREA IV
AREA III
AREA II
HS-6
HS-7
Sump and surge tower
Above Ground Baker Storage Tanks
Underground collection tanks
LEGEND
• Leachate Collection Well
— Leachate Trenches, Pipes
0 200 400 600
FEET

Project No. 120-RI2

Oil Industries Landfill

Camp Dres & McKee Inc.

LEACHATE COLLECTION SYSTEM

Figure 1-4

The leachate collection system in Area III, on the southwest corner of the site, consists of a series of buried, perforated pipes and trenches discharging into three buried steel tanks. The buried steel tanks consists of one 3,500 gallon tank which has the upper part of both ends perforated, an 8,000 gallon tank and a 10,000 gallon tank. Each tank can be individually pumped out. The tanks are resting in a gravel bed which can also be pumped to remove local leachate collected within the gravel bed surrounding the tanks. The 3,500 gallon tank, with perforations in the upper part of each end, is for collecting leachate in the gravel bed surrounding the cluster of tanks. All three tanks are from old vacuum trucks and do not meet current regulations for buried tanks. EPA plans to replace these tanks as part of a separate action.

Southwest and down-slope of the buried tanks, along the boundary of OII, is a french drain system which flows to a 36-inch diameter gravel sump. Leachate is pumped from the sump to the buried tanks.

Leachate collected in the buried tanks in Area III is pumped to three 20,000 gallon, above-ground Baker storage tanks located in the vicinity of the surge tower in Area IV. Leachate is removed from the storage tanks by a vacuum truck and transported off-site for treatment and disposal. During the period from April 1983 through October 1984, the leachate was trucked to and disposed of by OII in the active landfill working area in the western portion designated for liquid waste disposal. OII was ordered by the State of California to cease this practice in September, 1984.
The main leachate collection system in Area IV on the west side of the site is similar to the system in Area III, consisting of perforated pipe and trenches which feed to a 36-inch diameter sump in the vicinity of the surge tower. Leachate is pumped from the sump by two air lift pumps into the surge tower. The surge tower serves as a standpipe providing adequate head to gravity flow leachate into the buried tanks in Area III.

The leachate collection system in Area V is very similar to the system in Area I, consisting of trenches, perforated pipe and leachate disposal wells drilled into dry refuse. It is believed that leachate seeps occurred in this area during the stock piling of dirt immediately up-slope. When the dirt was removed, the leachate seeps disappeared.

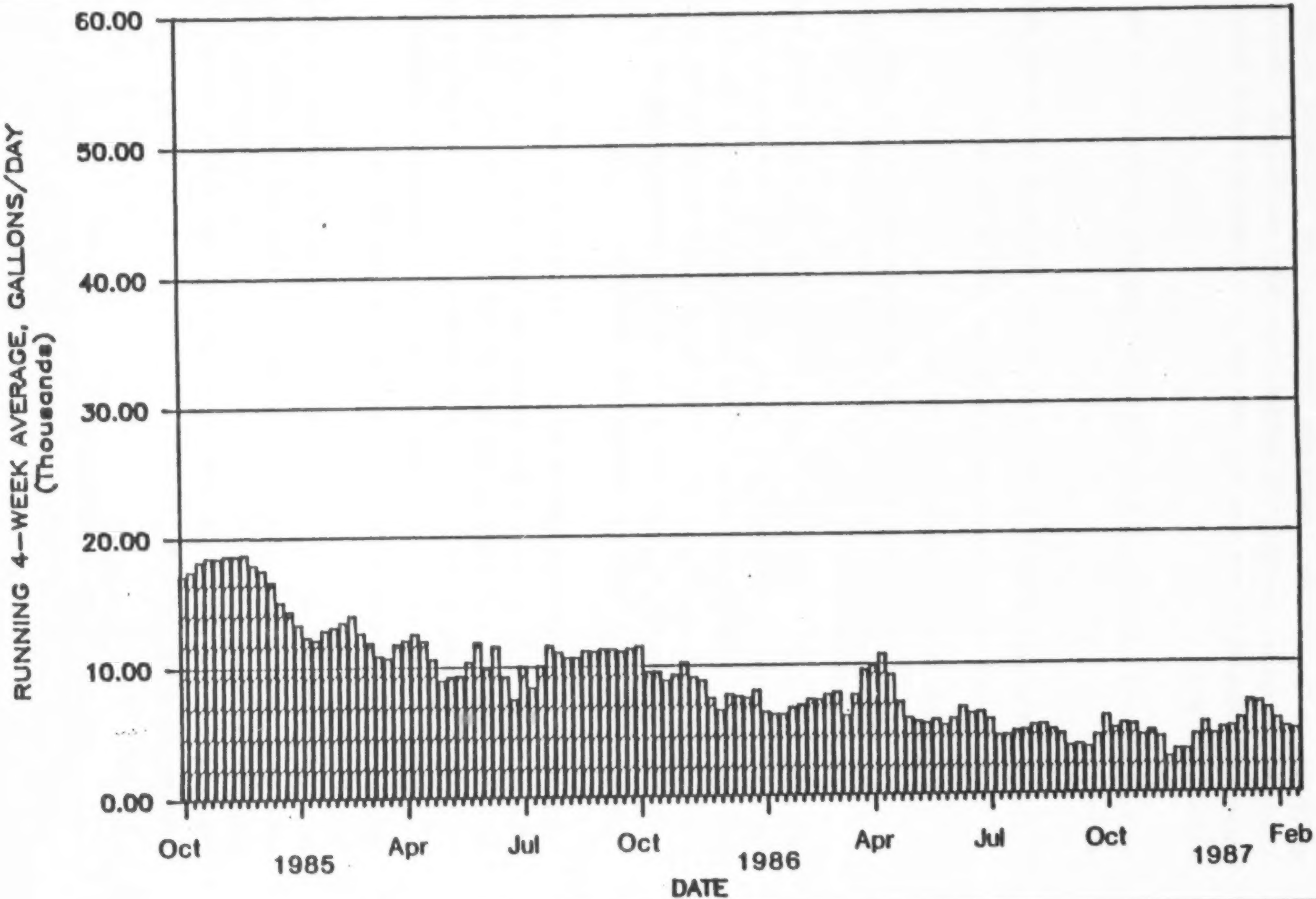
Repairs and improvements to the existing leachate collection system will be made by EPA as part of the Site Control and Monitoring remedial action, prior to the implementation of the leachate management remedy.

1.3.3 LEACHATE VOLUME

For the purposes of comparing management alternatives, an estimate was developed of the volumes of leachate/liquid that will be collected and require treatment and/or disposal. When the expanded leachate collection system was put into operation in April of 1983, the collected leachate was disposed back into the landfill. This procedure continued until October of 1984. During this period, no on-site hauling records were maintained. General estimates were made by OII as to the frequency which the storage tanks were evacuated. From these estimates an average daily collection rate of 30,000 gallons was approximated. Starting in October 1984, when the collected leachate was hauled off-site, trucking manifests were required. The leachate volumes presented in Figure 1-5 were developed from actual trucking manifest data provided by Lockman and Associates and Ecology & Environment. Figure 1-5 depicts a running four-week average of the estimated daily collection rate, based upon the volumes of leachate pumped from the storage tanks and trucked off-site.

A running four-week average was used in order to smooth out the variability associated with the pumping of the storage tanks. An examination of the 20 months of recorded pumpage doesn't show a marked "wet season" increase in the rate of leachate collection. As more data becomes available, it will be analyzed for "wet season" impacts. By providing on-site leachate storage, it is believed that wet season increases in leachate collection can be adequately managed.

Leachate was collected by OII at a rate of 25,000 to 30,000 gallons per day during the period from April 1983 to October 1984, when the leachate was being redisposed into the landfill. Collection rates showed an initial steep decline after October 1984, which may reflect the cessation of leachate redisposal. Deterioration of the collection system may also be



Project No.	Oil Industries Landfill	RECORD OF LEACHATE PUMPED FROM STORAGE TANKS FOR OFF-SITE DISPOSAL	Figure
120-RI2	Camp Dresser & McKee Inc.		1-5

reflected in the decline. Since the initial decline following cessation of leachate redisposal leachate collection rates have stabilized. Collection rates vary throughout the year but average approximately 4 to 6 thousand gallons per day.

Several factors contribute to the continued leachate production at the site:

- Metabolic liquids produced by decomposition of the waste mass;
- Liquid infiltration through the surface of the site;
- Liquids squeezed out of pore spaces as the landfill settles;
- Approximately 300,000 gallons of manifested liquids were deposited since 1977, and additional large volumes were deposited historically.

EPA estimates that volumes of leachate and hazardous liquids collected at OII will increase to approximately 10,000 gallons per day during the interim period before implementation of the final remedy for the site. This volume increase will be due primarily to improvements to the existing collection system and to improvements to collect condensate which is currently being recirculated through the landfill.

Condensate is a hazardous liquid which is generated from the cooling of moisture saturated gas during gas extraction. Currently, limited volumes of condensate are collected at the GSF and OII flare stations. Drip legs in the gas systems currently re-inject condensate into the landfill. As collection is expanded to trap the re-injected condensate, collected volumes could increase to several thousand gallons per day.

Additional amounts of liquids will be collected as the collection system is expanded to de-water inundated gas extraction wells and perimeter gas monitoring probes. Equipment decontamination during the ongoing RI/FS and construction activities will also generate minor additional volumes of liquids which may require treatment.

A combination of these factors contribute to EPA's estimate of interim leachate collection of 10,000 gallons per day. EPA believes this is the best estimate for formulating remedial action treatment alternatives and cost comparisons.

In the future, even greater volumes of hazardous liquids could be collected due to the potential need to collect and treat the following:

- Additional shallow leachate as a source control measure to prevent contamination of perched groundwater;
- Additional deep leachate as a source control measure to prevent groundwater contamination;
- Additional condensate resulting from expansion of the gas collection system;
- Additional leachate collection to enhance gas extraction.

Contamination has been detected in the groundwater in the site vicinity. Extraction and treatment of groundwater may also be required in the future. During the hydrogeological investigation, the water generated by well development, purging, and pump testing may have to be treated prior to discharge.

1.4 LEACHATE CHARACTERIZATION

The quality of leachate obtained from the Operating Industries, Inc. landfill has been highly variable, based on review of over 70 sets of sampling data from the past 42 months (January 1983 to July 1986). No consistent sampling and analysis program extending beyond a few months had been undertaken prior to EPA's sampling activity, and data reviewed illustrate the lack of consistent results and difficulty in assessing the characteristics of a representative sample of leachate. Although quality assurance information on some of the leachate data was not readily available, inclusion of all results to summarize leachate quality was believed to be appropriate to fully characterize the potential range of contaminant levels which may be present in OII leachate and to therefore evaluate the degree of flexibility which must be considered for treatment.

A summary of leachate analytical data is presented in Appendix C. Included in this appendix is a description of sampling locations, sampling agencies and data analysis methodology. Also summarized in tabular form are the number of sample results reviewed for each parameter and the mean, median, and range of pollutants identified in the OII leachate. Results for one leachate sample taken in July of 1986, for which a high quality analysis was performed by EPA's National Enforcement Investigations Center Laboratory (NEIC) and for which sampling analytical quality assurance could be readily verified, are not included in the compiled data in Appendix C; these results are included as a separate attachment to Appendix C (Addendum C-1).

The OII leachate can be described as a darkly colored liquid with a moderate petroleum and/or musky odor. Past analysis results have been highly variable and indicate that leachate may contain a wide array of organic and inorganic pollutants including oil and grease, chemical oxygen demand, suspended solids, dissolved solids, volatile organics, semivolatile organics, sulfides and a variety of heavy metals and other elements.

A summary of the range of several selected constituents found in OII leachate is presented below (from Table C-1 and Addendum C-1):

Parameter	Range of Values (mg/L except pH) Minimum	Maximum
pH	6.6	8.5
Oil and grease	6	296,800
Chemical oxygen demand	750	31,000
Suspended solids	62	62,800
Dissolved solids	7,226	16,300
Ammonia	720	927
Vinyl chloride	ND	0.50
Methylene chloride	ND	16.3
Toluene	ND	10.0
Xylene isomers	ND	5.0
1,4-Dioxane	ND	19.0
bis(2-ethylhexyl) phthalate	ND	60.0
Phenol	ND	1.8
Sulfides	ND	13.0
Chromium	ND	4.81
Arsenic	0.026	4.52
Zinc	0.06	18.0
Sodium	2,200	4,500
Calcium	116	367

ND: Not Detected

As illustrated in the table above and in Appendix C, many of the EPA Target Compounds (TC) have been identified in OII leachate at various times during the past few years. Heavy metals such as chromium, arsenic, zinc, cadmium, copper, lead, nickel, mercury, and selenium which are TCs have been found during elemental analysis of leachate and have ranged from below detection limits to several milligrams per liter. Average and median values of heavy metals in the leachate indicate that they are usually present in concentrations of less than one milligram per liter. Most of the metallic elemental character of leachate is represented by common mono and divalent species such as sodium, potassium, magnesium, calcium and iron. This conclusion was further substantiated by the high quality NEIC analysis which identified heavy metals ranging from detection limits to 340 micrograms per liter and common metals ranging from 16 to 3400 milligrams per liter.

Over one-third of the organic TCs as well as a variety of non-TCs have been detected at least once in an OII leachate sample. Organics which have been frequently identified in leachate include volatile aromatic compounds such as benzene, dichlorobenzene, ethyl benzene, toluene and xylene isomers, volatile halocarbons such as 1,1-dichloroethane, methylene chloride and vinyl chloride, and other volatile constituents such as acetone, methylethyl ketone and dioxane isomers. Also frequently identified were several semivolatile TCs including several phenol species, several phthalate esters, naphthalene, phenanthrene and 2-methylnaphthalene. These organics, along with many less frequently detected organic constituents have been found to be present in leachate at levels ranging from detection limits to several milligrams per liter. Average and median values for organic TCs presented in Appendix C indicated that they are usually present in concentrations of several hundred micrograms per liter or less. The high quality NEIC analysis generally substantiated this conclusion although high levels of 1,4-Dioxane (13 mg/l), 2-methyl- 2-butanol (1.4 mg/l), 2-methyl-2-propanol (2.0 mg/l) and bis(2 ethylhexyl) phthalate (1.1 mg/l) were identified in this particular sample.

Several analyses for organic constituents in OII leachate have indicated the presence of a complex organic matrix which consists largely of undifferentiated weathered hydrocarbon species which are not normally identified using conventional gas chromatographic and gas chromatographic/ mass spectroscopic techniques. Occasionally, analyzing laboratories have estimated the concentrations of organic acids and n-alkanes present in leachate. One set of results for a leachate sample taken in June of 1984 reported estimated levels of butanoic, pentanoic and hexanoic acids at levels of 1.6, 1.9 and 3.1 milligrams per liter, respectively. Other labs have estimated the levels of various n-alkanes (from 9 to 31 carbons) on several occasions and have reported total levels of several hundred milligrams per liter. The high quality NEIC analysis quantified the n-alkanes at a total level of 1.4 mg/l. It was also estimated, based on a total ion count for the chromatograms, that the total concentration of hydrocarbon material in this sample was 70 mg/l, most of which could not be specifically identified. Analysis showed that 68 percent of the dissolved organic carbon in the NEIC leachate sample could be attributed to organic acids.

In addition to metal and organic pollutant level determination, the concentrations of many other contaminants have been quantified in samples of OII leachate. The pH of leachate has generally been neutral or slightly basic. Oil and grease, chemical oxygen demand, and suspended solids have been found in highly variable concentrations with median values of 473 mg/l, 4,690 mg/l and 628 mg/l, respectively. Dissolved solids levels have been more consistent at mean and median levels of approximately 11,500 mg/l. Ammonia levels in OII leachate average approximately 820 mg/l based upon the two sets of results reviewed.

Based upon a review of the over seventy sets of available analytical data characterizing OII leachate, this waste was found to have a high strength character. The results were highly variable with respect to levels of specific organic and inorganic constituents, thus making the determination of a "representative sample" of leachate difficult. However, general categories of pollutants for which removal through treatment would be necessary could be readily established. These are oil and grease, metals, organics, and sulfides.

1.5 OBJECTIVES OF LEACHATE MANAGEMENT REMEDIAL ACTIONS

As discussed in previous sections, leachate seepage problems at the site have required the installation and operation of a leachate collection system. At the present time the collected leachate is being trucked off-site for treatment with effluent sewering.

The following objectives and considerations will guide the formulation of the remedial action alternatives for management of collected leachate.

- Remedial action alternatives must be easily and rapidly implemented and have the potential to be integrated into the overall remedial action plan for the landfill site.
- Formulated alternatives will be flexible in order to manage both short- and long-term variations in the leachate collection rate and in the chemical characteristics of the leachate.
- Remedial treatment actions which permanently and significantly reduce the volume, toxicity or mobility of the contaminants in the OII leachate are preferred over remedial actions not involving such treatment.

Long-term site remediation will be addressed in the on-going RI/FS study being conducted by the EPA for the site. The RI/FS for the site is expected to be completed in 1991.

2.0 DEVELOPMENT OF REMEDIAL ACTION ALTERNATIVES

2.1 GENERAL RESPONSE ACTION IDENTIFICATION

Based upon an analysis of the composition and volume of the leachate collected at the Operating Industries, Inc. (OII) landfill site, general response actions were identified which could adequately meet the site cleanup objectives identified in Section 1.6. These actions consisted of on-site treatment, on-site disposal, off-site treatment and off-site disposal. From these response actions specific remedial alternatives were developed. A "no action" general response alternative was also evaluated to provide a baseline with which other actions could be compared.

2.2 IDENTIFICATION OF REMEDIAL TECHNOLOGIES

Of the various treatment or disposal technologies for managing the collected leachate, several were excluded based on landfill site characteristics, leachate quality and technical considerations.

2.2.1 ON-SITE TREATMENT

An on-site treatment facility would only treat wastes from the OII site. No wastes from any other sites would ever be treated by a plant at the OII landfill. Technologies evaluated for an on-site leachate treatment facility included incineration, biological, chemical and physical treatment processes.

On-site incineration of OII landfill leachate was considered but rejected after evaluation. Incineration is a process which has been used for a broad range of hazardous and toxic substances such as organic solvents, sludges and oily wastes. Incineration technologies frequently used have included rotary kiln, fluidized bed, multiple hearth and liquid injection.

The method most adaptable to incineration of leachate would be rotary kiln with a secondary combustor. Although this incineration technology has been proven effective in treating a variety of toxic and hazardous wastes, extensive research into incineration of OII leachate would have to be conducted prior to process implementation. The highly variable quality of leachate with respect to oil and grease and organic constituents is of major concern. Development and maintenance of steady-state operating conditions would be extremely difficult as leachate quality varied. Injection rates and temperature adjustments would have to be thoroughly studied in order to assure adequate contaminant destruction. As a fuel, OII leachate would have a low BTU value due to its rather low organic content. This would necessitate the introduction of large amounts of a supplemental fuel source to initiate and sustain combustion which would make operation of the system very costly. Control of emissions would also be difficult due to variable leachate quality. Extensive testing would be required including pilot testing and test burns to assure that adequate contaminant destruction was achieved. Although incineration is a demonstrated technology for destruction of various types of toxic and hazardous wastes, the incineration of OII leachate is not proven effective and would require extensive research to properly develop and implement. The amount of research required could significantly delay implementation which would be contrary to the short-term goal of rapid implementation. Therefore, incineration was eliminated from further consideration.

Biological treatment of OII leachate at an on-site treatment facility was evaluated, but was eliminated due to site waste characteristics. Aerobic and anaerobic biochemical processes are widely utilized and well-documented municipal waste treatment technologies. Many industrial wastewater treatments also employ acclimated biomasses in the treatment process. However, several factors hinder applying this technology to leachate from the OII landfill. As stated previously and illustrated in Appendix C, the concentration of contaminants in the leachate from the OII site is highly variable with wide and unpredictable fluctuations in many of the leachate constituents. Biological systems are not able to readily adapt to changes in influent quality. Biological process control can be difficult in such situations of varying influent quality, and could result in low quality effluent. Data in Appendix C shows a very unfavorable average biological oxygen demand (BOD) to chemical oxygen demand (COD) ratio of 1 to 35 for biological treatment. These results indicate that most of the COD present in the leachate is nonbiodegradable or that OII leachate is toxic to the biomass. It is known that many of the specific organic constituents of concern in the leachate, such as the chlorinated hydrocarbons and aromatic solvents, are not easily biodegraded. These factors related to the OII leachate characteristics along with the potential disposal problem of the excessive quantities of biological sludge which could be produced by adequate biodegradation, led to the elimination of biological treatment from further consideration as a viable treatment alternative.

Physical and chemical waste treatment methods are considered to be the most appropriate categories of technologies to reliably treat collected leachate at the OII landfill site. A wide variety of unit processes exist in these categories of technologies. Treatment technologies were initially screened based on the specific characteristics of the OII leachate. Pollutants targeted for removal include heavy metals, volatile and semivolatile organic EPA Targeted Compound List (TCL) pollutants as well as oil and grease, and sulfides.

Many types of physical and chemical waste treatment technologies exist. Only proven technologies were considered for further evaluation and incorporation into the interim on-site leachate treatment remedial alternatives in order to facilitate rapid implementation. Table 2-1 lists categories of pollutants present in OII leachate and the physical/chemical treatment technologies which are commonly utilized for their reduction.

TABLE 2-1

TREATMENT TECHNOLOGIES

Pollutant Class	Treatment Technology
Heavy Metals	Coagulation, flocculation, precipitation, filtration, ion exchange, reverse osmosis
Oil and Grease	Gravity separation, dissolved air flotation, coagulation, and sedimentation
Organics	Air stripping, steam stripping, activated carbon, chemical oxidation, ultraviolet ozonation, reverse osmosis
Sulfides	Air stripping, steam stripping, chemical oxidation

Several of these technologies are currently being used by the off-site treatment facility which treats OII leachate and other liquid wastes with similar classes of pollutants.

2.2.2 ON-SITE DISPOSAL

Specific technologies which were considered for the on-site disposal of leachate collected at the OII landfill included land application and evaporation of leachate from lined surface impoundments. Other on-site disposal technologies, such as waste landfilling, were eliminated from further consideration as infeasible due to the large volume of leachate currently being collected and to various site characteristics.

Land application was initially considered as a viable on-site disposal technology but was later rejected due to site characteristics. Leachate recirculation is a practice used at newer lined municipal landfills in an attempt to stabilize leachates generated at the facilities. By continuously recycling collected leachate back through the landfill, the chemical quality of the waste is improved through biochemical, chemical and physical actions occurring within the landfill.

Recirculating leachate through the OII landfill would result in a redistribution of the waste without a significant reduction in the volume at the site. Coupled with the additional leachate generated within the landfill, and the constantly changing physical characteristics of the landfill, the existing leachate collection system is not adequately sized and located to prevent new seeps from occurring. Public exposure to leachate would likely continue to occur.

Although in other situations, recirculation has been proven to be effective in improving the chemical quality of leachate generated at landfills, this is not a feasible technology for effectively managing leachate collected at the OII site. Recycling collected leachate would continually increase the frequency of collection tank pumping, the existing collection system would be overwhelmed and new leachate bleeds would occur.

Site conditions specific to the OII landfill, including the lack of impermeable liners and the proximate location of a resident population, make leachate recirculation to accomplish site clean-up goals and objectives unacceptable. On-site leachate recirculation technology was therefore eliminated from further consideration.

A second potential on-site disposal technology is the construction of lined surface impoundments on the OII site to allow passive solar evaporation to occur. This alternative was considered as a feasible method of managing the collected leachate on-site and was included in the development of site remedial action alternatives.

2.2.3 OFF-SITE TREATMENT

Treatment at an off-site facility, in RCRA compliance, is the method which is presently being used to manage the leachate collected at the OII site. Since this is presently a viable alternative with the treated effluent satisfying discharge requirements, it was also included in the development of site remedial action alternatives.

2.2.4 OFF-SITE DISPOSAL

The disposal of leachate at a RCRA landfill was considered as a method of managing leachate collected at the OII landfill. The technologies used at off-site disposal sites were not considered as screening criteria at this point, but rather the compliance of disposal facilities with regulatory requirements. Since landfill disposal facilities exist which are in compliance with the regulatory requirements and could accept OII leachate, this technology was included for further evaluation.

2.3 DEVELOPMENT OF REMEDIAL ALTERNATIVES

Potential remedial action alternatives to manage leachate collected at the OII landfill site were formulated from the technologies screened above in a manner consistent with the requirements of the National Oil and Hazardous Substances Contingency Plan (NCP).

The NCP (40 CFR 300.68[f]) specifies that at least one remedial alternative shall be developed as part of the feasibility study in each of the following categories, to the extent that it is both possible and appropriate:

Category	Description
1	Alternatives for treatment or disposal at an off-site facility.
2	Alternatives that attain applicable or relevant and appropriate federal and state public health and environmental requirements.
3	Alternatives that exceed applicable or relevant and appropriate federal and state public health and environmental requirements.
4	Alternatives that do not attain applicable or relevant and appropriate federal and state public health and environmental requirements but will reduce the likelihood of present or future threat from the hazardous substances and that provide significant protection to public health and welfare and the environment. This must include an alternative that closely approaches the level of protection provided by the applicable or relevant and appropriate requirements.
5	No action alternative.

General response actions and associated technologies developed in Section 2.2 of this Feasibility Study (FS) include on-site treatment using selected physical/chemical waste treatment processes, on-site disposal utilizing surface impoundments to act as passive solar evaporators, off-site treatment at an approved RCRA facility and off-site disposal at a licensed and approved RCRA disposal facility.

2.4 IDENTIFICATION OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

In order to develop the five remedial alternatives specified in the NCP, the applicable or relevant and appropriate requirements (ARARs) must be identified for the remedial alternatives to be screened and evaluated.

Section 121 of the Superfund Amendments and Reauthorization Act of 1986 addresses cleanup standards and specifies that on-site actions should attain legally applicable or relevant and appropriate standards, requirements, criteria, or limitations. These include "any standard, requirement, criteria, or limitation under any federal environmental law" and "any promulgated standard, requirement, criteria, or limitation under a state environmental or facility siting law that is more stringent than any federal standard, requirement, criteria, or limitation" if it has been approved, authorized, or delegated by the Administrator and has been identified to the EPA by the state "in a timely manner." Applicable or relevant and appropriate requirements, criteria, advisories and guidance at the local level although not requiring evaluation under SARA were also considered in the development and evaluation of proposed remedial alternatives.

2.4.1 FEDERAL ARARs

Several Federal laws would apply to on-site remedial actions taken at the OII site. EPA intends to comply with federal ARARs for any off-site or on-site treatment or disposed alternative. Most of these laws are administered by State or local agencies. Subtitle C of the Solid Waste Disposal Act, entitled the Resource Conservation and Recovery Act (RCRA), would apply to on-site or off-site treatment or disposal facilities.

Regulations for new facilities involved in the treatment, storage, or disposal of hazardous wastes (40 CFR 264), developed from RCRA, are applicable to any new on-site treatment facility or surface impoundment.

The general pretreatment requirements of the Federal Clean Water Act would apply to any alternative which involves the ultimate disposal of collected OII leachate, whether treated or untreated, to a publicly-owned treatment works (POTW). Compliance with these standards is enforced by the Los Angeles County Sanitation District (LACSD). Discharge to a navigable waterway of treated or untreated leachate would be regulated under the National Pollutant Discharge Elimination System (NPDES) authority. Compliance with surface water discharge standards is enforced by the California Regional Water Quality Control Board (CRWQCB).

The applicability of the Clean Air act to an on-site treatment or disposal facility was determined to be applicable. A new source review provision of the act would apply to any new source of emissions and would be enforced by the SCAQMD.

2.4.2 STATE ARARs

Applicable or relevant and appropriate state requirements as well as local requirements for an on-site or off-site leachate treatment or disposal facilities were identified. It is the intent of the EPA to comply with state ARARs for any on-site or off-site treatment or disposal alternative. These ARARs were based on input from the California Department of Health Services (DOHS), California Waste Management Board (CWMB), Los Angeles County Sanitation Districts (LACSD), South Coast Air Quality Management District (SCAQMD) and the California Regional Water Quality Control Board (CRWQCB).

The California Department of Health Services implements the California RCRA program which would apply to remedial alternatives involving the treatment, storage or disposal of hazardous wastes. The California RCRA program is very similar to the federal RCRA program. Regulations are codified under Title 22 of the California Administrative Code. In addition to the federal and state RCRA regulations, a state regulation has been proposed which would prohibit the disposal of untreated liquid wastes in evaporation ponds.

The California Waste Management Board regulates landfills in the state under Title 14 of the California Administrative Code. Provisions of Title 14 which regulate the ponding of liquid could apply to on-site disposal activities. Additionally, a general nuisance provision which prevents excessive noise or odors from a site could apply to an on-site remedial measure.

The Los Angeles County Sanitation District (LACSD), along with the local city sewering agency, regulates discharges to its sanitary sewerage system, which serves the area surrounding the OII site. The LACSD sets effluent discharge standards which must be met for liquid wastes discharged to their sewer system to assure compliance with the Federal Clean Water Act. In order to obtain approval for connection to the off-site sanitary sewerage system from the local sewering agency (Monterey Park or Montebello) and LACSD, hydraulic capacity must be available and waste treatment capable of consistently meeting discharge limitations must be provided. The LACSD discharge limitations for any treatment facilities are presented in Table 2-2.

The South Coast Air Quality Management District regulates emissions to the atmosphere. Several specific provisions have been identified which would apply to on-site remedial actions at OII. Rule 402, entitled the nuisance provision, is a general prohibition against excessive emissions which could cause adverse effects including odors. Regulation 13 is a new source review provision which mandates that the net emissions from any new source cannot exceed 75 pounds of organics per day. In addition, another regulation currently being developed, and therefore not yet an ARAR, will set specific emission limits on toxic compounds.

The California Regional Water Quality Control Board regulates discharges to waterways under the Clean Water Act and is charged with protecting groundwater. The CRWQCB administers the California State NPDES program for discharges to surface waters. NPDES requirements would apply to an on-site treatment facility if the plant discharged to drainage channels leading to surface waterways. If an on-site facility alternative included reusing treated leachate as irrigation water, the Porter-Cologne Water Quality Control Act would apply. This limits total dissolved solids levels to less than 750 mg/l for water used for surface applications.

2.4.3 PERMITS

Section 121 of SARA states that "no federal, state, or local permit shall be required for the portion of any removal or remedial action conducted entirely on-site." However, the EPA is required to meet the substantive portion of the permitting requirements. Permits, therefore, would only be required for off-site activities. An industrial waste discharge permit and/or sewer connection permit from the appropriate city would be required for off-site discharge.

2.5 IDENTIFICATION OF REMEDIAL ALTERNATIVES

Based on the results of the remedial technology screening and in accordance with the requirements of the NCP, a set of remedial action alternatives for management of leachate collected at the OII landfill site was identified.

Several chemical and physical treatment processes were chosen using the technologies identified in Table 2.1. These process trains were selected to effectively and reliably remove pollutants of concern (oil and grease, organics, sulfides, and metals) from the OII leachate and provide a range of effluent qualities.

TABLE 2-2

EFFLUENT DISCHARGE LIMITS
FOR
CENTRALIZED HAZARDOUS WASTE TREATMENT FACILITIES

LOS ANGELES COUNTY SANITATION DISTRICT

Parameter[1]	Limitation (mg/l) (maximum for any time)
Arsenic (total)	3.0
Cadmium (total)	0.69
Chromium (total)	2.77
Copper (total)	3.38
Lead (total)	0.69
Mercury (total)	2.0
Nickel (total)	3.98
Silver (total)	0.43
Zinc (total)	2.61
Cyanide (total)	1.20
Sulfides (dissolved)	0.1
Total toxic organics[2]	1.0
Oil and grease	10.0
Vinyl Chloride	0.015
Radioactivity[3]	

[1] Limitations for other organic parameters and metals will be set as needed.

[2] Total toxic organics include a list of 111 compounds specified by LACSD. Volatile organics are to be analyzed using EPA Methods 601 and 602. Semi-volatile and non-volatile organics are to be analyzed using Method 625.

[3] In accordance with Title 17, California Administrative Code, Section 30287. Generally limited to 400 pCi/L above natural background.

Below are the remedial action alternatives developed for initial screening and the corresponding category of the NCP criteria identified on page 2-6:

Alternative	NCP Category
Off-site treatment	1
Off-site disposal	1
No action	5
On-site disposal using double-lined surface impoundments	2
On-site treatment facility with sewering of effluent	
. Oil and grease separation...discharge	4
. Oil and grease separation—> coagulant addition —> dissolved air flotation—> filtration —> air stripping...discharge	4
. Oil and grease separation —>coagulant addition—> dissolved air flotation—> filtration—> activated carbon...discharge	2
. Oil and grease separation—> coagulant addition—> dissolved air flotation—> filtration—> air stripping without off-gas treatment—> activated carbon...discharge	2
. Oil and grease separation—> coagulant addition—> dissolved air flotation—> filtration—> air stripping with off-gas treatment—> activated carbon...discharge	2
On-site treatment facility with reuse of effluent	
. Oil and grease separation—> coagulant addition—> dissolved air flotation—> filtration—> air stripping with off-gas treatment—> activated carbon—>ultrafiltration—> reverse osmosis...reuse	3

The likelihood of a treatment alternative attaining, not attaining, or exceeding the applicable or relevant and appropriate requirements will be discussed further during the screening process.

3.0 INITIAL SCREENING OF REMEDIAL ACTION ALTERNATIVES

The purpose of the initial screening of remedial action alternatives is to eliminate those alternatives which are ineffective or which are not cost-effective. Screening was performed in accordance with methodology set forth in the NCP (40 CFR 300.68[g]) and in the Guidance on Feasibility Studies Under CERCLA (EPA, 1985a).

3.1 CRITERIA FOR INITIAL SCREENING OF REMEDIAL ACTION ALTERNATIVES

Criteria for the initial screening of remedial action alternatives are listed below:

1. Effectiveness of Public Health Protection

The effectiveness of each of the proposed alternatives in protecting public health was evaluated. An alternative was considered to be ineffective if it did not meet all of the following criteria:

- Provided adequate protection of public health and welfare and the environment.
- Complied with established EPA policies for planning and implementing off-site remedial actions. Those policies are adopted to ensure protection of public health.
- Qualified as a preferred alternative under the Superfund Amendments and Reauthorization Act of 1986 (SARA). Under SARA, preferred alternatives are those which permanently and signficantly reduce the mobility, toxicity or volume of waste. Land disposal is classified as the least preferred alternative under SARA. Pteferred alternatives provide both short- and long-term benefits to public health.

Alternatives which did not meet these criteria were precluded from further consideration.

2. Cost

The cost of implementation, including operation and maintenance, was considered for each of the remedial action alternatives. Alternatives that greatly exceeded the cost of other actions without providing substantially greater protection to public health and the environment were eliminated from further consideration.

3.2 INITIAL SCREENING OF REMEDIAL ACTION ALTERNATIVES

A detailed description of the alternative screening is presented below.

3.2.1 ENDANGERMENT ASSESSMENT FOR NO-ACTION ALTERNATIVE

The endangerment assessment process for CERCLA sites evaluates the collective demographic, geographic; physical, chemical, and biological factors at a site to determine whether or not there is an imminent and substantial endangerment to public health or welfare or the environment as a result of a threatened or actual release of hazardous substances or wastes. It is important to note that "imminent" does not mean immediate harm, rather, an impending risk of harm. Sufficient justification for a determination of an imminent endangerment may exist if harm is threatened; no actual injury need have occurred or be occurring. Similarly, "endangerment" means something less than actual harm (EPA 1985a).

This section of the Leachate Management Feasibility Study (FS) presents a preliminary assessment of the potential risks to public health, welfare, or the environment in the absence of remediation at the OII landfill site. Available data for use in quantitatively characterizing potential exposures to chemicals present at the OII site consist primarily of leachate analyses and limited air monitoring results. These data present a preliminary representation of chemical concentrations in these media and have not been validated according to EPA Contract Laboratory Program (CLP) procedures. Furthermore, analytical data are not available for other environmental media of potential concern (e.g., soil, groundwater, surface water). Consequently, this assessment is qualitative (Level I) in nature. A more quantitative endangerment assessment (Level II or III) will be completed during the overall RI/FS process of the OII site as more data characterizing the site and the nature and extent of contamination are collected.

The remedial alternatives considered in this Feasibility Study for Leachate Management at the OII landfill consist primarily of interim source management and control measures for collected leachate. That is, the goal of remediation is to prevent exposure to contaminants and associated health risks by preventing or minimizing releases of collected contaminants until permanent remedial measures can be designed and implemented. EPA has noted in its Guidance on Feasibility Studies under CERCLA (April 1985) that an in-depth quantitative analysis is not warranted under these circumstances. However, to the extent permitted by the available data, a qualitative exposure analysis is required to evaluate the types, amounts, and concentrations of chemicals at the site, their toxic effects, the proximity of target populations, the likelihood of chemical releases and migration from the site, and the potential for exposure. As discussed in EPA's Endangerment Assessment Handbook, a quantitative health risk assessment may not be required for alternative selection or design when interim source management and control alternatives are under consideration because of the necessity to quickly evaluate suitable alternatives and implement the selected action. For the OII site, the current data limitations discussed above do not permit quantitative estimates of risks or determination of performance goals for individual chemicals for each of the alternatives considered. Consequently, as recommended in EPA's Feasibility Study Guidance, the reliability of remedies specified under each alternative for protecting human health, welfare, and the environment are evaluated, to some extent, in the context of engineering performance and reliability.

In this section of the Leachate Management FS report, chemicals of potential concern at the OII landfill are identified. Pathways of environmental exposure to chemicals present at the OII site are discussed and the potential endangerment to human health, welfare, and the environment under the no action alternative are qualitatively evaluated. This assessment is used as a basis for evaluating the interim leachate management remedial alternatives developed for the site in succeeding sections of this report. It should be noted that the chemicals of concern and exposure pathways evaluated in this preliminary assessment may be modified as more data are developed for the final OII landfill RI/FS.

Chemicals of Concern. A number of potentially hazardous chemicals have been placed in the OII landfill or have been generated as a result of in situ biological or chemical processes. In this subsection, chemicals identified in environmental media in the vicinity of the landfill are characterized. In addition, a subset of representative chemicals of concern is selected and the potential toxic effects of these chemicals are discussed.

Chemical Characterization. Available data characterizing chemicals associated with the OII landfill consist primarily of analyses of leachate generated by the landfill. Results of approximately 70 sets of leachate analyses performed from 1983 to 1986 are summarized in Appendix C. The data presented include the minimum, maximum, and mean concentrations of chemicals detected in the landfill leachate. Leachate samples were collected at a variety of locations both on and off the OII landfill site. Sampling locations include leachate sumps, underground transfer and dumping lines, vacuum trucks, leachate seeps, and holding tanks at off-site treatment facilities. Analyses were conducted at several laboratories and the results for individual chemicals or parameters shown in Appendix C were not necessarily reported for each leachate sample analyzed.

As shown in Table C-1 in Appendix C, the range of reported values for chemicals detected in landfill leachate is very wide, varying in some cases by several orders of magnitude. No consistent trends in chemical concentrations either at particular sampling sites or site-wide are apparent over the period of 3.5 years for which data are available. These observations hold for data pooled from all sampling locations as well as for data from individual sampling locations. Variability in these data may be due to a number of factors including: (1) collection of samples from many different sources at different times of the year, (2) differences in leachate generation rates and composition associated with different source areas at the site or with environmental factors, and (3) inconsistencies in sampling and analytical procedures used.

Although current ambient air monitoring data are not available, based on the limited data discussed below, surface and subsurface emissions of landfill gases are partially controlled at present by active gas extraction and flaring. However, the data are limited which compare the occurrence of landfill gases in the vicinity of the OII site prior to and after operation of these control systems. Analyses of ambient air sampled during 1983 and 1984 at locations just outside the boundary of the southern parcel of the landfill indicated the presence of vinyl chloride, benzene, and toluene on several occasions. The detection limits for these compounds were 2 ppb, 5 ppb, and 10 ppb, respectively. Vinyl chloride was detected frequently and was reported at concentrations as high as 19 ppb. Benzene was detected relatively infrequently, but was reported at concentrations as high as 36 ppb. Toluene was detected almost daily during the sampling period and was reported at concentrations as high as 80 ppb. Summary statistics for the Los Angeles area compiled by EPA reported ambient concentrations of 19.2 ug/m^3 and 44.3 ug/m^3 for benzene and toluene, respectively, for the second quarter of 1979. Because current air monitoring data in the vicinity of the landfill are not available and cannot be compared to current background air samples, it is not possible to determine with certainty the overall contribution of landfill gases to the ambient levels measured. EPA will conduct additional ambient air monitoring in 1988.

Analyses also were performed to characterize the composition of gas being extracted from the site, and to characterize vapors collected above leachate in collection tanks and on the landfill surface. Chemicals detected in samples of gas extracted from the OII landfill included vinyl chloride (6-30 ppm), benzene (4-15 ppm), hydrogen sulfide (15 ppm), carbon disulfide (10 ppm), 1,2-dichloroethane (0.51 ppm), trichloroethylene (2.4-39 ppm), and tetrachloroethylene (1.7-40 ppm). Vapor samples collected above leachate on the surface of the landfill contained 0.5-13 ppm vinyl chloride.

Spontaneous subsurface fires also have been reported to have occurred within the OII landfill. Such fires may cause chemical reactions which drive off volatile materials into the surrounding air. Samples of air above two fires indicated vinyl chloride concentrations of 0.64 and 8 ppm, the benzene concentration above one of these fires was 55 ppb.

In addition to the analytical data summarized above, there have been reports of unpleasant odors at the site and in surrounding residential areas. The anaerobic decomposition of organic wastes often produces a complex mixture of low molecular weight compounds, many of which contain sulfhydryl groups and are quite odorous. For example, hydrogen sulfide and carbon disulfide, gases with quite noxious odors, have been detected in landfill gas at concentrations far greater than their odor thresholds (0.0011-7.7 ppm for carbon disulfide, 0.00001-0.8 ppm for hydrogen sulfide).

Substantial amounts of methane gas also are generated within the OII landfill. Methane has been detected in enclosed spaces in offsite residential areas at concentrations from 1 percent to greater than 50 percent.

As summarized above, only data characterizing landfill leachate and limited data characterizing volatile compounds present in landfill gases currently are available. The landfill leachate characterization data are highly variable. This variability may reflect actual differences in leachate composition at different sampling points, seasonal or other environmentally-regulated differences in leachate generation rates and relative dilution of the individual components, differences in the individual components analyzed for in each sample and the limited number of analyses performed for some chemicals, and differences in laboratory analytical and reporting procedures (including detection limits). However, no clear trend associated with these or other factors potentially affecting the results was identified and representative leachate samples for potentially important exposure points or environmental migration pathways could not be identified. It may be necessary to collect a larger number of consistently selected and analyzed samples to clarify these uncertainties. As noted above, ambient air monitoring data and other analyses of compounds present in landfill gases are limited. In addition, the detection limits in air for vinyl chloride and benzene, used in the previously conducted studies of the local ambient air quality, are greater than concentrations that would be associated with excess cancer risks of one in one million (10^{-6}) for lifetime ambient exposure, and thus are too high to permit a sufficiently sensitive evaluation of health risks. For these reasons and because data characterizing other environmental media of concern (e.g., groundwater, soil, surface water) are not available, a quantitative exposure and risk assessment cannot be completed. Nevertheless, a number of potential pathways of exposure to chemicals present at the OII landfill in the absence of leachate management can be described and the potential effects on health, welfare, and the environment can be assessed qualitatively.

Representative Chemicals of Concern. As part of a site-specific risk assessment for which a large number of chemicals have been detected, a subset of key chemicals of concern (indicator chemicals) is often selected. This is intended to focus the assessment on chemicals that pose the greatest potential public health risks at a site. Indicator chemicals ideally should represent the most toxic, mobile, and persistent chemicals at the site, as well as those present in the largest amounts. In the Superfund Public Health Evaluation (PHE) Manual (EPA 1986a), EPA recommends a procedure for selection of indicator chemicals. The procedure involves ranking all chemicals found at a site according to indicator scores derived by multiplying environmental chemical concentrations by medium-specific (soil, water, air) toxicity constants. A subset of the chemicals is selected after consideration of individual chemical rankings and other factors, including: environmental persistence and mobility, frequency of detection, comparison with laboratory or field blanks, and comparison with background concentrations. Many components of this selection procedure require professional judgment by the individual evaluating the available data.

Chemicals present at the OII site have not been sufficiently characterized to permit indicator chemical selection based on rigorous considerations of their occurrence in individual environmental media. Toxicity constants that would be applicable for use in ranking contaminants present in leachate are not available. Indicators were selected according to several criteria. As a surrogate for toxicity constants applicable for leachate we have used the toxicity constants for water and have ranked the leachate chemicals based on the product of these values and their mean concentrations in landfill leachate. (A ranking based on a product of the soil toxicity constant and leachate concentration gave similar results.) Although the toxicity constants used are not designed for use with leachate analyses, the results obtained provide an approximate indication of which are likely to be the chemicals posing the greatest hazard. Other factors considered were physiochemical properties, severity of effect, and environmental persistence and mobility. Using these criteria a representative subset of chemicals was selected to include both inorganic and organic chemicals as well as chemicals having carcinogenic effects and noncarcinogenic systemic effects. The chemicals selected were not necessarily those which were ranked highest based on the indicator scores calculated using the toxicity constants. An attempt was made to select representative inorganic and organic chemicals because, in addition to differences in their toxic effects, the environmental fate and transport of representative of these two classes tend to differ appreciably. Although potential carcinogens tend to pose greater health risks than noncarcinogens at hazardous waste sites, a few representative noncarcinogenic chemicals also were selected as indications. For example, although phenol had a relatively low ranking, this noncarcinogenic chemical was selected because of its relatively high mobility in the environment. Although hydrogen sulfide was not reported in landfill leachate, this chemical has been detected in landfill gas and may pose odor problems in the vicinity of the site. Consequently, it was selected as a representative chemical of concern. Likewise, although vinyl chloride and benzene were ranked relatively low based on concentration in leachate, these carcinogenic chemicals are of relatively high volatility and have been detected in ambient air near the OII site. Therefore, these chemicals were selected as representative chemicals of concern based on their potential to pose health risks via the inhalation route of exposure. Carcinogenic polycyclic aromatic hydrocarbons (CPAHs) were selected as an indicator chemical group for this assessment. Potential health risks associated with polycyclic aromatic hydrocarbons (PAHs) are due primarily to the carcinogenic components present in mixtures of these compounds. The only CPAH reported in the OII leachate monitoring data was benzo(a)anthracene. However, it is likely that other CPAHs are present in leachate, but were not specifically analyzed for and quantified.

A total of 17 representative chemicals of concern were selected from the more than 80 chemicals detected and are shown in Table 3-1 along with their mean and maximum concentrations in landfill leachate. It should be noted that data concerning the occurrence of site-related chemicals in environmental media and the local and regional environmental characteristics that may influence the fate and transport of these chemicals are lacking. Consequently, it currently is not yet possible to confidently quantify the occurrence of these chemicals in environmental media or to select indicator chemicals with confidence. The representative chemicals of concern shown in Table 3-1 were selected only to provide a general indication of the potential endangerment to health, welfare, and the environment associated with the OII landfill site.

Some of the OII leachate samples were characterized with regard to radiation levels. Four grab samples of leachate from the OII site analyzed for radioactivity had mean alpha (gross) and mean beta (gross) activities of 35 pCi/liter and 389 pCi/liter, respectively. The value for gross alpha activity exceeds the drinking water MCL of 15 pCi/liter. However, this standard assumes consumption of 2 liters of drinking water per day and would not be directly applicable to leachate. An MCL also exists specifying that beta particle and photon radioactivity from man-made radionuclides in drinking water shall not produce a dose to the total body or any organ greater than 4 mrem/year. However, specific data on the radionuclides emitting beta radiation at the OII site are not available. Because analytical data concerning the alpha and beta emitters in OII leachate are limited, potential risks cannot be adequately characterized and will not be considered further in this assessment. It should be noted, however, that available data suggest radiation levels in OII leachate samples may be similar to local natural background radiation levels.

It is expected that a more complete set of validated monitoring data will be available for the overall RI/FS for the OII site and that a systematic and rigorous indicator chemical selection process will be possible for the final RI/FS. Accordingly, the list of chemicals considered in the final RI/FS may be revised.

Toxicity of Representative Chemicals. This section contains brief qualitative descriptions of the toxic effects of the representative chemicals of concern selected for the OII landfill site. In addition, these brief toxicity profiles summarize the currently available standards and criteria for these chemicals and health-based exposure guidelines. The health-based criteria noted in the profiles consist of cancer potency factors for potential carcinogens and reference doses (RfDs) for chemicals exhibiting noncarcinogenic effects.

EPA's Carcinogen Assessment Group (CAG) has developed cancer potency factors for estimating the upper-bound excess lifetime cancer risks associated with various levels of lifetime exposures to potential human carcinogens. In practice, cancer potency factors are derived from the results of human epidemiology studies or chronic animal bioassays. The data from animal studies typically are fitted to a linearized multistage model and a dose-response curve is developed. This approach provides rough, but plausible, estimates of the 95% upper confidence limits on lifetime risks. While the actual risks are unlikely to be higher than the estimated risks, they could be considerably lower. The slopes of the dose-response data derived from low-dose human epidemiological studies are fitted to dose-time-response curves on an ad hoc basis. This approach is typically used to provide a best estimate of lifetime excess cancer risks, but may in fact overestimate or underestimate actual risk.

Health criteria for chemicals exhibiting noncarcinogenic effects are generally developed using EPA Reference Doses (RfDs) developed by the RfD Work Group, or RfDs obtained from Health Effects Assessments (HEAs), Drinking Water Criteria Documents, or Drinking Water Health Advisories

TABLE 3-1
REPRESENTATIVE CHEMICALS OF CONCERN
OII LEACHATE MANAGEMENT FS
REM II

Chemical	Concentration in Landfill Leachate (mg/liter) Mean	Maximum
Acrylonitrile	-	0.120
Ammonia	-	720
Arsenic	0.37	4.52
Barium	4.82	18
Benzene	0.067	0.300
Cadmium	0.035	0.405
1,2-Dichloroethane	0.162	0.29
2,4-Dinitrotoluene	-	0.070
Hydrogen sulfide	-	-
Lead	0.50	2.9
Mercury	0.02	0.302
Phenol	0.397	1.80
Polychlorinated biphenyls[a]	0.360	0.772
CPAH[b]	0.068	0.130
Selenium	0.32	1.97
Trichloroethylene	0.19	0.320
Vinyl chloride	0.114	0.50

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[a] Value shown is the sum of the concentrations reported for PCB-1248 and PCB-1260.

[b] Carcinogenic polycyclic aromatic hydrocarbons (CPAHs) are considered as a group in this assessment. The value reported is for benzo(a)-anthracene, the only CPAH currently quantified in OII leachate.

(HAs). The RfD is an estimate (with uncertainty spanning perhaps an order of magnitude or greater) of a daily exposure to the human population (including sensitive subpopulations) that is unlikely to pose an appreciable risk of deleterious effects during a lifetime. The RfD is typically expressed in units of mg/kg/day (Barnes 1986). RfDs or minor variations of these criteria have also been referred to as acceptable intakes for chronic exposure (AICs) and acceptable daily intakes (ADIs) in various EPA publications.

Acrylonitrile

Acrylonitrile is associated with a significant excess of respiratory cancer in workers exposed by inhalation to this compound (O'Berg 1980) and is classified in EPA's weight of evidence for carcinogenicity Group B1, Probable Human Carcinogen (limited evidence of carcinogenicity in humans from epidemiological studies). EPA's Carcinogen Assessment Group (CAG) calculated a cancer potency factor for exposure via inhalation of 0.24 $(mg/kg/day)^{-1}$ based on the O'Berg (1980) study. Acrylonitrile administered in drinking water produced increased incidences of tumors at multiple sites in three different strains of rats (EPA 1983). EPA's CAG used data from all three of these drinking water studies to calculate a cancer potency of 0.54 $(mg/kg/day)>^{-1}$ for estimation of human risks associated with ingestion of acrylonitrile.

In its ambient water quality criteria document for acrylonitrile, EPA (1980a) calculated a cancer potency of 0.552 $(mg/kg/day)^{-1}$ based on one of the three drinking water studies in rats noted above. The resulting ambient water concentration calculated to keep the lifetime excess cancer risk below 10^{-6} was 0.058 mg/liter. This value assumes ingestion of contaminated water and aquatic organisms from the contaminated water. Without consumption of aquatic organisms from contaminated water, a lifetime cancer risk of 10^{-6} would be associated with ingestion of water containing 0.063 mg/liter of acrylonitrile.

Ammonia

Ammonia is a colorless gas with a penetrating, pungent, suffocating odor. It is a severe irritant of the eyes, respiratory tract, and skin. Ammonia may be absorbed by inhalation, ingestion, and percutaneously, although it is most likely to be an inhalation hazard. The inhalation of anhydrous ammonia gas in industrial accidents has produced acute and chronic respiratory effects. Ingestion of ammonia/water solutions may produce esophagitis and gastritis. The exact nature and intensity of toxic effects associated with exposure to ammonia are reported to be unpredictable (Gosselin et al. 1984). The OSHA standard for occupational exposure to ammonia is 35 mg/m^3 (50 ppm).

Arsenic

Arsenic is associated with an increased incidence of lung, liver, bladder, and skin cancer in individuals exposed via drinking water (Tseng et al. 1968; Chen et al. 1986) and with an increased incidence of lung cancer in occupationally exposed workers (Brown and Chu 1982). EPA's Carcinogen Assessment Group (CAG) calculated a cancer potency factor for exposure via ingestion of 15 $(mg/kg/day)^{-1}$ based on the Tseng et al. (1968) study, and calculated a cancer potency factor for inhalation exposure of 50 $(mg/kg/\text{-}day)^{-1}$ based on several occupational studies. These potency factors can be used to estimate risks associated with human exposure to arsenic. EPA has classified arsenic in Group A — Human Carcinogen — based on the weight of the evidence for carcinogenicity. EPA's Office of Drinking Water has promulgated a drinking water maximum contaminant level (MCL) of 50 mg/liter for arsenic and has also presented this value as a proposed recommended maximum contaminant level (RMCL), currently referred to as a maximum contaminant level goal (MCLG) (EPA 1985b).

The EPA Risk Assessment Forum is currently reevaluating the potency of ingested arsenic, and preliminary results suggest that the cancer potency factor for skin cancer will be lowered by approximately one order of magnitude. However, the internal tumors associated with ingestion exposure have not been considered by EPA, and consideration of these tumors may ultimately serve to raise the cancer potency factor.

Barium

Toxic effects of ingestion of barium include gastroenteritis, muscular paralysis, hypertension, cardiotoxicity, including ventricular fibrillation, and damage to the central nervous system (Perry et al. 1983). Inhalation of barium sulfate or barium carbonate dust causes baritosis, a benign pneumoconiosis, in occupationally exposed workers. This effect is reversible upon cessation of exposure. Using the EPA's criteria for evaluating weight of evidence of carcinogenicity in humans, barium is most appropriately classified in Group D, Not Classified. This category applies to agents with inadequate evidence of carcinogenicity.

EPA has established a drinking water MCL of 1 mg/liter for barium. The EPA Office of Drinking Water (EPA 1985b) proposed an MCLG of 1.5 mg/liter based on a study by Perry et al. (1983) in which rats were exposed to barium in drinking water. The proposed MCLG was derived by using the RfD of 0.021 mg/kg/day calculated from this study and factoring in data on human exposure. EPA's (1984a) acceptable intake for chronic oral exposure (AIC) to barium also was based on the Perry et al. (1983) study and is equivalent to the RfD of 0.051 mg/kg/day. For inhalation exposure, EPA calculated acceptable chronic and subchronic intakes (AIC and AIS) of 1.4×10^{-4} mg/kg/day and 1.4×10^{-3} mg/kg/day, respectively, from a study by Tarasenko et al. (1977) in which exposure of male rats to 0.8 mg/m^3 barium resulted in no observed toxic effects.

Benzene

A series of epidemiological studies, both cohort and case-control, showed statistically significant associations between leukemia and occupational exposure to benzene (Aksoy 1985, Wong 1982, Rinksy et al. 1987, Ott et al. 1978). Similar results have been obtained in a number of countries and in different industries (IARC 1982). In addition, oral exposure of experimental animals to benzene has been associated with increased incidences of Zymbal gland and mammary gland carcinomas (NTP 1986). The toxic effects of benzene in humans and other animals also include central nervous system effects, hematological effects, and immune system depression (EPA 1985c).

Applying EPA's criteria for evaluating the overall weight of evidence of carcinogenicity to humans, benzene has been classified in Group A — Human Carcinogen. This category indicates that there is sufficient evidence from epidemiological studies to support a causal association between an agent and cancer.

The EPA Carcinogen Assessment Group (CAG) calculated a cancer potency factor for benzene derived from human epidemiological studies (Ott et al. 1978, Rinsky et al. 1981) in which significantly increased incidences of leukemia were observed for workers exposed to benzene, principally by inhalation (EPA 1986b). EPA proposed a "single best judgment" estimate of 2.9×10^{-2} $(mg/kg/day)^{-1}$. A cancer potency factor estimate for oral exposure based upon human occupational exposure was derived by EPA (1980b, 1984a). The inhalation-based oral estimate of 5.2×10^{-2} $(mg/kg/day)^{-1}$ was derived using an absorption adjustment factor to estimate oral exposure from inhalation data. The concentration in water corresponding to a 10^{-6} excess lifetime cancer risk is 0.66 mg/liter (EPA 1980b).

EPA (1985c) promulgated a final drinking water maximum contaminant level goal (MCLG) of zero because benzene is a human carcinogen. A final drinking water MCL of 5 mg/liter has been promulgated (EPA 1987a). MCLGs consider only health effects whereas MCLs consider analytical issues, treatability, occurrence, cost, and health effects. The EPA Office of Drinking Water developed a ten-day health advisory (HA) of 235 mg/liter for children (EPA 1987b). Health advisories for longer exposure periods were not developed because of the potent carcinogenic response of benzene (EPA 1987b).

Cadmium

Cadmium has not been demonstrated to be a systemic carcinogen, but has been shown to be a highly potent pulmonary carcinogen by inhalation (Takenaka et al. 1983), and adverse renal effects are associated with ingestion.

The MCL established for cadmium by EPA in its national interim primary drinking water standards and the ambient water quality criterion for the protection of human health are both 10 mg/liter (EPA 1980c). EPA established the standard for cadmium on the basis of the "generally accepted" estimate of 200 mg/g wet weight of cadmium in the renal cortex as the critical concentration for renal toxicity. Friberg et al. (1974) estimated that daily ingestion of 250-350 mg cadmium over 50 years would result in such renal concentrations. Other more recent reviews suggest that 200 mg/day is an acceptable daily limit for cadmium intake.

The EPA Office of Drinking Water has promulgated a proposed RMCL (MCLG) of 0.005 mg/liter (EPA 1985b). The proposed MCLG is based on the estimate of 200 mg/g wet weight of cadmium in the renal cortex as the critical concentration for renal toxicity (Friberg et al. 1974) and a 25% contribution to daily exposure from drinking water. An RfD of $5x10^{-4}$ mg/kg/day can be derived from the EPA Office of Drinking Water (ODW) analysis (not including the source contribution factor for drinking water).

EPA (1984b) recommended that 20 mg/liter be applied as the maximum additional increment from drinking water sources based on the drinking water criterion level of 10 mg/liter cadmium proposed by EPA (1980c) and assuming that an adult consumes 2 liters of water per day. The resulting AIC is $5.7x10^{-4}$ mg/kg/day (assuming that an individual weighs 70 kg).

Applying the criteria described in EPA's Guidelines for Assessment of Carcinogenic Risk, cadmium has been classified by EPA on the basis of inhalation data in Group B1 — Probable Human Carcinogen. This category applies to agents for which there is limited evidence from human studies and sufficient evidence from animal studies.

For inhalation exposure, a cancer potency factor of 6.1 $(mg/kg/day)^{-1}$ was calculated by EPA (1985d) based on a study by Thun et al. (1985). This value was derived from epidemiological data and is subject to a wide range of uncertainty.

1,2-Dichloroethane

Human exposure by inhalation to 1,2-dichloroethane has been shown to cause headache, dizziness, nausea, vomiting, abdominal pain, irritation of mucous membranes, and liver and kidney dysfunctions (EPA 1984c). Dermatitis may be produced by skin contact.

1,2-Dichloroethane has produced a variety of tumors in rats and mice. Applying EPA's criteria for evaluating overall weight of evidence of carcinogenicity to humans, 1,2-dichloroethane is classified in Group B2 as a probable carcinogen in humans. EPA (1985e) derived a cancer potency factor for ingestion based on the incidence of hemangiosarcomas in Osborne-Mendel male rats observed in a NCI (1978a) gavage study. Based on the hemangiosarcoma response in male rats using a time-to-death adjustment and an adjusted dose derived from the metabolism/kinetic evaluation, EPA used the multistage model to estimate an upperbound carcinogenic potency factor of 9.1×10^{-2} $(mg/kg/day)^{-1}$ for 1,2-dichloroethane.

EPA (1980d) also based the ambient water quality criterion for 1,2-dichloroethane on the incidence of hemangiosarcomas observed in male rats in the NCI (1978a) study noted above. However, because a somewhat different approach was used, a carcinogenic potency factor of 3.697×10^{-2} $(mg/kg/day)^{-1}$ was derived. The resulting water concentration to keep the lifetime excess cancer risk below 10^{-6} was 0.94 mg/liter. This value assumes ingestion of contaminated water and aquatic organisms (e.g., fish) from the contaminated water. Without consumption of contaminated aquatic organisms, a lifetime cancer risk of 10^{-6} would be associated with ingestion of water containing 0.95 mg/liter of 1,2-dichloroethane.

EPA (1985e) used the negative inhalation data obtained in a study with rats and mice by Maltoni et al. (1980) to calculate an inhalation upper-bound estimate of carcinogen potency of 3.5×10^{-2} $(mg/kg/day)^{-1}$. However, the discrepant tumor responsiveness between oral and inhalation bioassays adds a degree of uncertainty to the estimate of inhalation cancer potency.

The EPA Office of Drinking Water developed a longer-term health advisory (HA) for 1,2-dichloroethane based upon the results of two chronic inhalation studies (Heppel et al. 1946, Spencer et al. 1951) and one subchronic inhalation study (Hofmann et al. 1971) in which various animal species were exposed to 1,2-dichloroethane. The HAs derived for a 10-kg child consuming 1 liter of water per day and for a 70-kg adult consuming 2 liters of water per day are 740 mg/liter and 2,600 mg/liter, respectively (EPA 1987c).

EPA (1987a) recently promulgated a maximum contaminant level (MCL) of 5 mg/liter for 1,2-dichloroethane. The MCL was determined based upon consideration of best available technology for removal of 1,2-dichloroethane from drinking water and upon the lowest achievable detection level for 1,2-dichloroethane by routine laboratory operating conditions within specified limits of precision and accuracy.

2,4-Dinitrotoluene

The most important acute toxic effect caused by exposure to 2,4-dinitrotoluene is the induction of methemoglobinemia followed by cyanosis. Symptoms reportedly caused by exposure to this compound include vertigo, fatigue, nausea, dyspnea, drowsiness, tremor, paralysis, unconsciousness, chest pain, and heart palpitation (EPA 1980e).

2,4-Dinitrotoluene is carcinogenic to rats after oral administration, producing mammary tumors, hepatocellular carcinomas, and hepatocellular neoplastic nodules in chronic bioassays (NCI 1978b, EPA 1980e). Applying EPA's criteria for evaluating the overall weight of evidence of carcinogenicity to humans, 2,4-dinitrotoluene is classified in Group B2 as a probable carcinogen in humans. EPA (1980e) derived a cancer potency factor for ingestion of 0.31 $(mg/kg/day)^{-1}$ based on the incidences of mammary and/or liver tumors in rats observed in a NCI (1978b) study. EPA (1980e) based the ambient water quality criterion for 2,4-dinitrotoluene on these studies. The resulting ambient water concentration calculated to keep the lifetime excess cancer risk below 10^{-6} was 0.11 mg/liter. This value would be approximately the same for ingestion of contaminated water and aquatic organisms or for consumption of contaminated water alone.

Hydrogen Sulfide

Hydrogen sulfide is a colorless gas with a characteristic rotten egg odor. Inhalation exposure to concentrations of 70 to 280 mg/m^3 may irritate the eyes and lungs. At higher concentrations (~280 to 700 mg/m^3), exposure may result in headaches, dizziness, and nausea. One or two inspirations of hydrogen sulfide at concentrations of 700 to 1,400 mg/m^3 may result in swift collapse, coma, and death from respiratory failure (Gosselin et al. 1984, NRC 1979, Merck 1983). Because hydrogen sulfide is rapidly detoxified in the body, any decrease in the intensity of exposure after inhalation of such high concentrations may produce spontaneous, rapid revival (Gosselin et al. 1984). The odor threshold for hydrogen sulfide is below 1.4 mg/m^3. However, odor is not a dependable way to detect hydrogen sulfide since exposure to high concentrations (above 280 mg/m^3) paralyzes the sense of smell.

EPA (1986c) has calculated an oral RfD of 3×10^{-3} mg/kg/day for hydrogen sulfide based on the results of feeding studies in pigs. Although lacking in some details, the study evaluated by EPA suggested that adult pigs experienced digestive disorders when their diet was adjusted to include an intake of 15 mg/kg/day hydrogen sulfide. These effects were not seen at intake levels of 3.1 mg/kg/day.

Lead

The major toxic effects caused by exposure to lead are alterations in the hematopoietic and nervous systems. Anemia caused by lead exposure has the following pathogenesis. Heme synthesis is inhibited by the effects of lead on a number of steps in the biosynthetic pathway. No threshold has been identified for this effect on heme production. Decreased heme production results in decreased hemoglobin production and anemia. Decreased heme production can also have deleterious effects on other heme-containing proteins, such as cytochrome P450, which detoxify certain chemicals in the body. Impaired heme synthesis has been reported in adults at levels of less than 30 mg/dl lead in the blood (EPA 1984d, 1984e).

Two types of neurotoxic effects are associated with exposure to lead. Levels of lead in the blood (PbB) of over 80 mg/dl in children and over 100 mg/dl in sensitive adults can cause severe, irreversible brain damage, encephalopathy, and possibly death. Persons with these high levels may be asymptomatic or show only slight signs of intoxication, but rapid deterioration can occur. In children, permanent learning disabilities are seen at these levels, even if there are no overt signs of lead poisoning (EPA 1984d, 1984e).

Other adverse effects are associated with exposure to low levels of lead. Slow nerve conduction in peripheral nerves has been found in adults at 30-40 mg/dl blood lead level (PbB); altered testicular function was observed in men with PbB levels as low as 40-50 mg/dl; and renal dysfunction has been associated with PbB levels as low as 40 mg/dl (EPA 1984d, 1984e).

Oral ingestion of certain lead salts (lead acetate, lead phosphate, lead subacetate) have been associated with increased renal tumor frequency in rats (EPA 1985f), but no quantitative estimate of excess cancer risk has been performed by the Carcinogen Assessment Group of EPA. EPA (1985f) has noted that the available data provide an insufficient basis on which to regulate lead acetate, lead phosphate, and lead subacetate as human carcinogens. However, applying the criteria described in EPA's Guidelines for Carcinogenic Risk Assessment, these lead salts have been classified by EPA in Group B2 — Probable Human Carcinogen.

The MCL for drinking water and the ambient water quality criterion are both 50 mg/liter for lead. A drinking water RMCL (MCLG) of 20 mg/liter has been proposed by the EPA Office of Drinking Water (ODW). The proposed RMCL

(MCLG) is based upon the health effects of lead in infants and pregnant women as a sensitive subpopulation (EPA 1985f). An RfD of 6×10^{-4} mg/kg/day can be derived based on the ODW analysis.

The Clean Air Act National Ambient Air Quality Standard for lead is 1.5 mg/m^3. This standard is currently being evaluated for possible revision (EPA 1985g).

Acceptable intakes for chronic or subchronic periods of exposure were not calculated for either inhalation or oral ingestion in the Health Effects Assessment Document (EPA 1984e) because the general population is already accruing unavoidable background exposures through food, water, and dust. Any significant increase above background exposure would represent a cause for concern.

Mercury

Mercury has long been recognized as one of the more toxic metals. The toxicity of mercury depends to some extent on its form; it can be part of both inorganic and organic compounds. Mercury has been shown to have adverse neurological effects in humans. Organic mercury compounds are generally more neurotoxic than inorganic mercury. In addition, the different forms of mercury can cause somewhat different neurotoxic effects initially, although both will elicit the same effects at higher doses (EPA 1984f). Central nervous system lesions similar to those in humans, proteinuria, and morphological kidney changes have been reported in animals exposed to mercury (Koller 1979, EPA 1985h).

No data are available regarding the carcinogenic potential of mercury in humans or animals. Applying the criteria for evaluation of the overall weight of evidence of carcinogenicity to humans proposed by EPA, mercury is most appropriately classified in Group D — Not Classified (EPA 1984f). The MCL for mercury is 2 mg/liter. An RMCL (MCLG) of 3 mg/liter has been proposed (EPA 1985b).

EPA (1986c) has derived an RfD for inorganic mercury of 0.002 mg/kg/day based on an oral chronic study with rats (Fitzhugh et al. 1950). An RfD for methyl mercury of 0.0003 mg/kg/day was developed by EPA based on several studies reporting human poisonings. These RfDs are the currently accepted critical toxicity values for oral exposure to inorganic mercury and methyl mercury. The EPA Environmental Criteria and Assessment Office (EPA 1984f) extrapolated an inhalation AIS of 0.51 mg/kg/day from the threshold limit value (TLV) for mercury vapor. An inhalation AIC of 0.051 mg/kg/day was derived by applying an additional safety factor of 10 to the AIS.For organic mercury, the oral AIS and the oral AIC of 0.28 mg/kg/day were based on data from an outbreak of mercury poisoning in Niigata, Japan (Miettinen 1973). The inhalation AIS and AIC of 0.1 mg/kg/day were derived from the TLV (EPA 1984f).

Phenol

Signs of acute phenol toxicity in humans and experimental animals are central nervous system depression, collapse, coma, cardiac arrest, and death. Acutely toxic doses can also cause extensive necrosis at the site of exposure (eyes, skin, oropharynx) (EPA 1980f).

In a subchronic oral (gavage) study in rats (Dow Chemical Co. 1976), 0.1 g/kg phenol induced "slight liver changes and slight to moderate kidney damage" in animals. However, lack of study details (numbers of animals, incidence figures, specific lesions) in the 1980f EPA document make these results unreliable for interpreting the toxic changes. Subchronic inhalation studies conducted by Deichmann and Witherup (1944) in guinea pigs, rabbits, and rats were inadequately designed (no control groups).

Therefore, caution should be used in interpreting the pulmonary, myocardial, renal, and hepatic damage as compound induced. The results of other subchronic inhalation studies are difficult to interpret based on the information in secondary sources (EPA 1980f, 1984g).

Applying EPA's criteria for overall weight of evidence of carcinogenicity, phenol has been classified in Group D — Not Classified (EPA 1984g). This category applies to agents for which there are no adequate data available regarding carcinogenicity in humans or experimental animals.

An RfD of 0.1 mg/kg/day for ingestion of phenol was based on the Dow Chemical Co. (1976) subchronic rat study (EPA 1986c). The ambient water quality criterion (AWQC) of 3.5 mg/liter/day for drinking water was extrapolated from this study. The AWQC based on organoleptic properties was established at 0.3 mg/liter (EPA 1980f).

An inhalation AIC of 1.4 mg/person/day was recommended by EPA (1984g) based on the threshold limit value of 19 mg/m^3 phenol established by the American Conference of Governmental Industrial Hygienists (ACGIH 1983).

PCBs

PCBs have a number of documented toxic effects on humans and other mammals. In considering the health effects of PCB exposure observed in humans, it is important to note that PCBs are often contaminated with highly toxic impurities, particularly polychlorinated dibenzofurans (PCDFs). As the effects due to PCDFs versus PCBs have not been separated in most human studies and because the two cause similar effects, reported toxicities are generally associated with commercial mixtures. The reader should recognize that at least some of the reported effects may be due to the PCDF impurities.

Dermatitis and chloracne (a disfiguring and long-term skin disease) have been the most prominent and consistent findings in studies of occupational exposure to PCBs. Reports of both chloracne and other PCB-related skin effects have generally been associated with exposures to more highly chlorinated PCB mixtures containing 42% chlorine or more (Chase et al. 1982, Emmett et al. 1983, Maroni et al. 1981a,b, Fischbein et al. 1979).

Several studies examining liver function in exposed humans have reported disturbances in blood levels of liver enzymes (Maroni et al. 1981b, Chase et al. 1982, Smith et al. 1982, Emmett et al. 1983). There is no evidence that a "no-effect" level exists for these effects, since correlations were found in individuals with low mean blood PCB levels.

Reproductive outcomes of women exposed to PCBs from high consumption of PCB-contaminated fish from Lake Michigan were compared to births from women who reported no such exposure (Fein et al. 1984a,b, Jacobson et al. 1983, Jacobson et al. 1984). Reduced birth weights, slow weight gains, reduced gestational ages, and behavioral deficits in infants were reported in a methodologically sound study. The study did not, however, rigorously establish that the causative factor was exposure to PCBs rather than other contaminants present in Lake Michigan fish.

Based on the published literature, reproductive, hepatic, and immunotoxic effects appear to be the most sensitive noncarcinogenic endpoints of PCB toxicity in nonrodent species, and the liver appears to be the most sensitive target organ for toxicity in rodents.

PCBs are not highly toxic when given as a single oral dose to mammals (Kimbrough et al. 1978), and would be classified as only slightly toxic based on acute oral toxicities (Hodge and Sterner 1949). The more significant toxic effects of PCBs are observed after repeated exposure over a period of time (EPA 1985i).

A number of studies have suggested that PCB mixtures are capable of increasing the frequency of tumors in animals exposed to the mixtures for long periods (Kimbrough et al. 1975, NCI 1978c, Schaeffer et al. 1984). EPA's Carcinogen Assessment Group (EPA 1985i) calculated a low-level cancer potency factor for PCBs based on a study of rats exposed to Aroclor 1260 (Kimbrough et al., 1975). The data on liver tumor incidence in the rat study were used in the linearized multistage model to calculate 95% upper confidence limits on risk. The cancer potency factor for lifetime exposure to PCBs is 4.34 $(mg/kg/day)^{-1}$. EPA (1984h) classified the weight of the evidence for carcinogenicity as B2 — Probable Human Carcinogen based on sufficient evidence in animal bioassays and inadequate evidence from studies in humans. Based on the Schaeffer et al. (1984) study, one would expect less chlorinated PCB mixtures to be less potent, but potency factors for mixtures other than Aroclor 1260 have not been calculated.

EPA (1980g) derived an Ambient Water Quality Criterion (AWQC) for the protection of human health from the potential carcinogenic effects of PCBs through ingestion of contaminated water and contaminated aquatic organisms. The recommended AWQC corresponding to a 10^{-6} incremental increase of cancer risk over a lifetime is 0.079 ng/liter. For ingestion of contaminated water only, the PCB concentration that would correspond to a 10^{-6} excess cancer risk is 8.1 ng/liter.

PAHs

Several of the PAHs have been shown to be potent carcinogens in animals, producing tumors both at the site of application and systemically. Not all PAHs have been shown to be carcinogenic, and some carcinogenic PAHs are clearly more potent than others. For regulatory purposes, EPA separates the PAHs into two categories, the "carcinogenic" and "noncarcinogenic" PAHs. This is a somewhat simplistic categorization, as many of the "non-carcinogenic" PAHs have been shown to have some, albeit quite weak, carcinogenic activity or to act as promoters or cocarcinogens while some of the "carcinogenic" PAHs are considerably less potent than others.

The approach adopted by EPA (1984i) as the basis for risk assessment is to apply a cancer potency factor calculated from bioassays on benzo[a]pyrene (B[a]P, one of the more potent carcinogens) to the subclass of carcinogenic PAHs. EPA calculated a cancer potency factor of 11.5 $(mg/kg/day)^{-1}$ for oral exposure to B[a]P (and the carcinogenic PAHs) based on a study by Neal and Rigdon (1967). A cancer potency factor for inhalation of B[a]P of 6.1 $(mg/kg/day)^{-1}$ was derived based on a study by Thyssen et al. (1981). IARC (1983, 1984), in reviewing the carcinogenicity of the PAHs, indicated those for which there was sufficient, limited, inadequate, or adequate negative evidence of carcinogenicity (Table 3-2). The more potent carcinogens are almost certainly included in the group for which sufficient evidence of carcinogenicity is available, but all PAHs for which sufficient or limited evidence of carcinogenicity is available will be considered as carcinogenic PAHs for purposes of this assessment.

Selenium

Selenium is an essential element in animals and probably in humans (EPA 1980h, 1984j). However, exposure to amounts only slightly above the required levels can produce acute and chronic toxic effects. Acute toxicities of selenium compounds vary greatly, while the chronic effects of most forms are similar. Acute effects include degeneration of liver, kidneys, and heart; hemorrhages in the digestive tract; and brain damage. Eye, nose and throat irritation may also occur with inhalation exposure. Chronic toxicity in humans appears to occur only in living areas where foods containing excessive concentrations of selenium are ingested. Signs of chronic intoxication include depression, nervousness, dermatitis, gastrointestinal disturbances, dental caries and discoloration, lassitude, and partial loss of hair and nails.

Applying the criteria proposed by the Carcinogen Assessment Group of EPA, selenium is classified in Group D — Not Classified. However, there is no evidence that selenium is carcinogenic in humans (EPA 1984j).

Selenium is an essential element, and the National Academy of Sciences has estimated an adequate and safe intake of selenium of 0.01 to 0.02 mg/day for adults to prevent deficiency (EPA 1985j).

The MCL for selenium is 0.01 mg/liter. This level is based on signs of selenium toxicity at an intake of 0.7 to 7 mg/day and an assumed selenium intake of 200 mg/day (EPA 1985b). EPA (1985b) recently proposed an RMCL (MCLG) of 0.045 mg/liter based on a provisional AADI of 0.106 mg/liter derived from results of a chronic human study with data on human exposure factored in. The Ambient Water Quality Criterion (AWQC) is 10 mg/liter (EPA 1980h). Glover (1967) measured urinary selenium concentrations in workers at a selenium rectifier plant over a 5-year period. He also attempted to correlate airborne selenium levels with urinary selenium levels and any adverse effects of selenium exposure in the workers. Based on his study, Glover recommended maximum allowable air concentration of 0.1 mg/m^3 for selenium exposure in the workplace.

EPA (1984j) used the study by Glover (1967) to calculate an inhalation AIC of 0.001 mg/kg/day. EPA (1984j) determined an AIC for ingestion of $3x10^{-3}$ mg/kg/day based on results of a chronic human study by Yang et al. (1983).

Trichloroethylene

Trichloroethylene is a central nervous system depressant from acute and chronic exposure. High level exposure can result in death due to respiratory and cardiac failure. Trichloroethylene was once used as a general anesthetic, but its use was discontinued due to longer-term CNS effects. The longer-term effects may have been due to impurities introduced by soda lime used to remove carbon dioxide (EPA 1980i).

The hepatotoxic potential of trichloroethylene has been evaluated in human and animal studies. Animal studies have revealed transient increased liver weights with relative liver weights decreasing postexposure (Kjellstrand et al. 1983). Observations of liver or renal dysfunction in workers have been infrequent, and factors other than trichloroethylene probably were more causally related to the hepatorenal disturbances noted (EPA 1985k).

Industrial use of trichloroethylene is often associated with dermatological problems, including reddening and skin burns on contact, and dermatitis resulting from vapors. These effects are usually the result of contact with concentrated solvent, however, and no effects have been reported after exposure to trichloroethylene in dilute, aqueous solutions (EPA 1985k).

EPA's Risk Assessment Forum (EPA 1985c) classified trichloroethylene in Group B2 — Probable Human Carcinogen (sufficient animal evidence of carcinogenicity and inadequate human evidence). The National Academy of Sciences has classified it as an animal carcinogen (EPA 1985c). These designations are based primarily in the results of animal bioassays in which exposure to trichloroethylene was associated with an increased incidence of liver tumors in mice (NCI 1976, NTP 1982, NTP 1984). However, it should be noted that EPA's Science Advisory Board concluded that a definitive scientific opinion concerning the carcinogenicity of trichloroethylene could not be made at that time because the interpretation of male mouse hepatocellular carcinomas is uncertain and the animal evidence is limited (EPA 1985c).

Because of its classification as a carcinogen, neither AISs nor AICs for trichloroethylene were calculated by EPA in its Health Effects Assessment (HEA) for this compound (EPA 1984k). The Carcinogen Assessment Group derived cancer potencies of 1.1×10^{-2} $(mg/kg/day)^{-1}$ for oral exposure and 4.6×10^{-3} $(mg/kg/day)^{-1}$ for inhalation exposure. These estimates are based on the mouse liver tumor data in the NCI (1976) and NTP (1982) gavage studies (EPA 1984k).

The drinking water MCL for trichloroethylene is 5 mg/liter. The Office of Drinking Water (EPA 1987d) issued a draft lifetime health advisory of 260 mg/liter for the noncarcinogenic effects of trichloroethylene. A relative source contribution factor was not included. The estimated excess cancer risk associated with lifetime exposure to drinking water containing 260 mg/liter of trichloroethylene is 8.2×10^{-5}.

Vinyl Chloride

Occupational exposure to vinyl chloride has been associated with an increased incidence of hepatic angiosarcomas. Vinyl chloride exposure has also been implicated in brain, lung, and hemolymphopoietic cancers in humans. Animal studies in several species support the findings of epidemiological studies. Chronic inhalation and ingestion of vinyl chloride has induced cancer in the liver (liver angiosarcomas and hepatocellular carcinomas) and in other tissues in rats and mice (IARC 1979).

TABLE 3-2
CLASSIFICATION OF PAHs ACCORDING TO EVIDENCE FOR CARCINOGENICITY

Chemicals for which there is sufficient evidence that they are carcinogenic in animals:

Benzo(a)anthracene
Benzo(b)fluoranthene
Benzo(j)fluoranthene
Benzo(k)fluoranthene
Benzo(a)pyrene
Dibenzo(a,h)acridine
Dibenzo(a,j)acridine
Dibenzo(a,h)anthracene
7H-Dibenzo(c,g)carbazole
Dibenzo(a,e)pyrene
Dibenzo(a,h)pyrene
Dibenzo(a,i)pyrene
Dibenzo(a,l)pyrene
Indeno(1,2,3-c,d)pyrene
5-Methylchrysene

Chemicals for which there is limited evidence that they are carcinogenic in animals:

Anthranthrene
Benzo(c)acridine
Carbazole
Chrysene
Cyclopenta (c,d)pyrene
Dibenzo(a,c)anthracene
Dibenzo(a,j)anthracene
Dibenzo(a,e)fluoranthene
2-, 3-, 4-, and 6-Methylchrysene
2- and 3-Methylfluoranthene

Chemicals for which the evidence is inadequate to assess theircarcinogenicity:

Benzo(a)acridine
Benzo(g,h,i)fluoranthene
Benzo(a)fluorene
Benzo(b)fluorene
Benzo(c)fluorene
Benzo(g,h,i)perylene
Benzo(c)phenanthrene
Benzo(e)pyrene
Coronene
1,4-Dimethylphenanthrene
Fluorene
1-Methylchrysene
1-Methylphenanthrene
Perylene
Phenanthrene
Triphenylene

Chemicals for which the available data provide no evidence that they are carcinogenic:

Acenaphthene
Acenaphthylene
Anthracene
Dibenzofuran
Fluoranthene
2-Methylnaphthalene
Naphthalene
Pyrene

Source: IARC 1983, 1984.

At high inhalation exposure levels, workers have experienced dizziness, headaches, euphoria, and narcosis. In experimental animals, inhalation exposure to high levels of vinyl chloride can induce narcosis and death. Lower doses result in ataxia, narcosis, congestion and edema of the lungs, and hyperemia in the liver (EPA 1985l).

Chronic inhalation exposure of workers to vinyl chloride is associated with hepatotoxicity, central nervous system disturbances, pulmonary insufficiency, cardiovascular toxicity, gastrointestinal toxicity, and acro-osteolysis (EPA 1985a). Chronic studies of experimental animals exposed to vinyl chloride by inhalation or ingestion report effects involving the liver, spleen, kidneys, hematopoietic system, and skeletal system (EPA 1984l).

Applying EPA's criteria for evaluating the overall weight of evidence of carcinogenicity to humans, vinyl chloride has been classified in Group A — Human Carcinogen.

EPA (1984) reported cancer potency factors for exposure by inhalation and ingestion to vinyl chloride. The cancer potency for inhalation is based on an inhalation bioassay in rats (Maltoni and Lefemine 1975) in which liver angiosarcomas were the predominant tumors observed. Using the linear nonthreshold model, the data of Maltoni and Lefemine (1975), and interspecies scaling factors, a human cancer potency of $2.5\text{x}10^{-2}$ $(\text{mg/kg/day})^{-1}$ was calculated.

The cancer potency for oral exposure to vinyl chloride is based on a long-term ingestion study in rats (Feron et al. 1981) in which increased incidence of hepatocellular carcinoma and hepatic angiosarcomas were observed. Using the data of Feron et al. (1981) and interspecies scaling factors, a human cancer potency of 2.3 $(\text{mg/kg/day})^{-1}$ was calculated. The EPA Carcinogen Assessment Group (CAG) is presently reassessing the cancer risk estimate based on the Feron et al. (1981) study by evaluating the more recent data by Til et al. (1983) which is an extension of the earlier Feron et al. (1981) work, but includes lower doses.

EPA (1985c) promulgated a drinking water RMCL (MCLG) of zero because vinyl chloride is a human carcinogen. A drinking water MCL of 0.002 mg/liter has also been promulgated (EPA 1987a). The State of California has established an ambient air standard of 10 ppb for vinyl chloride.

Potential Exposure Pathways. An environmental exposure pathway usually consists of the following elements: (1) a source and mechanism of chemical release to the environment; (2) an environmental transport medium for the released chemical (e.g., air, groundwater); (3) a point of potential human or biota contact with the contaminated medium (referred to as an exposure point); and (4) a route of exposure at the exposure point (e.g., ingestion, inhalation, or dermal contact). In the discussion that follows, a number of exposure pathways of potential concern for the OII site are presented for individual environmental media (leachate/soil, air, groundwater, surface water). The pathways considered are those that are likely to be important in the absence of leachate management activities at the OII site. This discussion is based on currently available information and it should be noted that individual pathways may be added, excluded, or modified for the final overall RI/FS for the OII site as more information is made available.

Leachate/Soil. Leachate from the OII landfill can potentially act as both a source of contamination and a medium of transport. Although surface soil in the vicinity of the site is likely to have originally been free of chemical contamination, contamination of surface soil has subsequently occurred. Seepage of leachate has been observed from side slopes of the fill area and migration to offsite areas has been reported. It can be expected that, in the absence of leachate management activities, leachate seeps will continue to appear and evaporate and also run off-site. Depending on the physiochemical characteristics of the soil and leachate components, this may result in surface migration of contaminants or in selective accumulation of some contaminants in surface soils.

Under the no-action alternative, pumping of leachate from the Iguala Wells and the sumps in landfill Areas III and IV (Figure 1.4) and pumping of leachate from the underground collection tanks to the above-ground storage tanks would be discontinued. Because the passive leachate collection system would continue to operate, the existing wells, sumps, and tanks located primarily in the southern portion of the landfill, would quickly fill to capacity, and overflow. A large volume of leachate would concentrate in this area of the landfill and would eventually flow offsite. Leachate not intercepted by the Iguala wells would appear as off-site surface seepage on the slopes of Iguala Park and could run over the sidewalks and roadways into the storm sewers.

In the absence of leachate management measures, contamination of surface soil with chemicals from the OII landfill could potentially occur both on site and offsite. The landfill is elevated and exposed. The slopes of the filled area are steep and, in some areas, extend beyond the boundaries of the landfill property. Transport of contamination beyond the site boundaries could potentially occur through a number of processes: (1) leachate breakthrough on the landfill slopes with seepage to offsite areas, (2) physical movement of leachate or contaminated soil as a result of slope instability or erosion, and shallow migration of leachate offsite causing surface seepage of points off the site, and (4) emanation of gases from shallow leachate offsite via capillary movement and evaporation. Although data currently available indicates that contaminants are not transported offsite in surface runoff or precipitation, it should be noted that runoff coming in contact with leachate would be a mechanism for carrying contaminants offsite. Contamination could potentially reach residential neighborhoods in the City of Montebello, the Iguala Park area, the storm sewer system, and a number of office complexes and developed areas in the vicinity of the landfill.

Individuals working in the vicinity of the site (including sewer waters) and local permanent residents (including adults and children), may potentially be exposed to site-related contaminants. Exposure may occur offsite or, if access to the site were not restricted, among trespassers venturing onto the site. Potential routes of exposure to contaminants in leachate or soil at onsite or offsite exposure points would involve direct contact with these media and subsequent dermal absorption or incidental ingestion of the chemical contaminants. Direct contact would be most likely to occur among individuals regularly working outdoors (e.g., construction workers, sewer workers, gardeners) or children. Ingestion of contaminated materials by children may occur more frequently than would normally be expected due to the sweet-smelling nature of some of the organic substances present in the landfill leachate.

Air. Individuals living or working in the vicinity of the OII landfill also can potentially be exposed by inhalation to site-related contaminants. In the absence of leachate management systems, release of the more volatile components of landfill leachate (e.g., vinyl chloride, benzene, trichloroethylene) to ambient air could contribute to airborne contaminant concentrations. During periods of weather inversions, airborne site-related contaminants could be more persistent and ambient concentrations could increase above levels likely to occur under less stable weather conditions. In addition, other components present in leachate (e.g., cadmium, lead, PAHs, PCBs) are more likely to adsorb to soil particulates and may thus become suspended as airborne particulate matter. Potential exposure to landfill gases generated at the OII site (e.g., methane, hydrogen sulfide, vinyl chloride) is considered in detail in the Feasibility Study for Site Control and Monitoring Alternatives. Because control of landfill gases is not associated primarily with leachate management, landfill gases will not be considered further in this report.

Groundwater. The potential exists for chemicals present in the OII landfill to contaminate local groundwater. Chemicals in the landfill can be transported to groundwater in leachate or via dissolution by rainwater and subsequent percolation through soil, and via migration in landfill gases to groundwater. Groundwater is an important regional resource and is used for drinking water, irrigation, and other domestic purposes in the vicinity of the site. The greatest potential exposures via groundwater would be most likely to occur either via direct ingestion, dermal contact during washing and other domestic uses, and inhalation of volatile components in the water.

Surface Water. Current drainage patterns at the OII site are such that runoff to nearby surface water bodies is not considered a significant exposure pathway. However, leachate can flow offsite, enter the local storm sewer system, and subsequently migrate to surface water or groundwater. Leachate does not meet the requirements for a NPDES permit. Individuals can potentially be exposed to contaminants originally present in leachate and transported to surface water (or groundwater) by direct contact, ingestion, or inhalation. The potential for exposure via this pathway is likely to be highest for workers in the sewer system where the least amount of dilution of leachate is expected to occur and where leachate-related gases could build up to higher concentrations than in open spaces.

Other Exposure Pathways. Some site-related chemical contaminants may be taken up by plants and translocated to edible plant parts. Individuals subsequently ingesting such food products could thus be exposed. If chemicals capable of being taken up by plants reach local residential gardens in soil, leachate, or irrigation water, exposure by this route could be of potential concern. In addition to direct uptake by plants, soil contaminants could potentially reach foliage or fruit via volatilization from soil or leachate or due to direct deposition of airborne soil particulates.

Potential adverse effects on pets or wildlife in the vicinity of the OII site are likely to be associated primarily with contaminated leachate, soil, dust, surface water, or airborne contaminants. No domestic or farm animals are believed to be present in the study area. However, free-ranging pets which contact contaminated soil or leachate or consume contaminated prey may be at risk of exposure. Some animals (e.g., cats) may be exposed by direct ingestion during grooming. Pets also may track contaminated soil to their owners' homes. Terrestrial mammals, birds, and other wildlife also may be exposed to contaminants in surface soil or leachate; aquatic life may be exposed to contaminants reaching surface water.

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Preliminary Risk Assessment. In this section, information on the potential for exposure to site contaminants is evaluated along with available standards and criteria to evaluate possible risks to human health, welfare, or the environment. A number of chemicals that may produce toxic effects in exposed individuals have been detected at the OII site. Two general types of criteria are typically used to assess the potential health risks associated with exposure to these chemicals: (1) applicable or relevant and appropriate requirements (ARARs), and (2) health-based exposure guidelines. In addition to consideration of health factors, ARARs may also reflect the technological and economic feasibility of removing a chemical contaminant from the environmental media of concern. Health-based guidelines reflect consideration of only the health risks associated with environmental contaminants.

Applicable or Relevant and Appropriate Requirements (ARARs). Remedial actions selected under the Superfund Amendments and Reauthorization Act of 1986 (SARA) must attain levels of cleanup of hazardous substances released into the environment and of control of further releases which assure protection of human health and the environment. SARA specifies that any selected remedial action must require a level of control which at least attains requirements that are legally applicable to the hazardous substances of concern or relevant and appropriate under the circumstances of release or threatened release. Accordingly, EPA guidelines for preparing risk assessments as part of the RI/FS process (EPA 1986a) recommend comparison of chemical concentrations found at or near a site with chemical-specific ARARs. Under SARA, EPA at a minimum currently considers maximum contaminant levels (MCLs) and maximum contaminant level goals (MCLGs) developed under the Safe Drinking Water Act, federal ambient water quality criteria (AWQC), national ambient air quality standards (NAAQS), and state standards to be potential ARARs for use in risk assessment at Superfund sites. In addition, other relevant criteria or guidance may be useful in assessing baseline risks or developing goals for remedial action.

Potential ARARs for contaminants of concern at the OII site that would be useful in assessing risks associated with ingestion of contaminated drinking water are shown in Table 3-3. There currently are no data available characterizing the extent of groundwater contamination, in the vicinity of OII landfill. Thus, comparison of the criteria and standards shown in

Table 3-3 with concentrations in groundwater is not possible. All of the leachate contaminant concentrations in Table 3-1 exceed the drinking water criteria shown in Table 3-3, many by more than an order of magnitude, which could suggest a potential for contamination of local groundwater beyond concentrations protective of human health, welfare, and the environment. However, leachate contaminants may undergo attenuation due to chemical, physical, and biological processes prior to reaching groundwater.

There are no NAAQS and or chemical-specific air standards under the California State Implementation Plan (SIP) directly applicable to the OII site. However, there is a State of California ambient air standard of 10 ppb for vinyl chloride that has been exceeded in ambient air concentration measurements in the vicinity of the landfill. In addition, as discussed above, there are data which indicate that the concentration of landfill gases at the perimeter of the OII site exceeds 5% methane, a limit stipulated by a California Waste Management Board landfill gas migration requirement.

Qualitative Risk Characterization. If ARARs are not available for all representative chemicals of concern and for all exposure scenarios considered, EPA guidance requires that a site-specific risk assessment be conducted. As noted in previous sections of this report, analytical data describing the extent of contamination in environmental media in the vicinity of the site are inadequate to allow a quantitative risk assessment. However, based on the information that is available, potential risks posed by the OII landfill site will be discussed qualitatively in the following sections.

As noted above (Potential Exposure Pathways), individuals living or working in the vicinity of the OII site could be exposed by direct contact (with subsequent dermal absorption or incidental ingestion) to contaminants present in soil or leachate if no action were taken to manage leachate collected at the site. The likelihood of exposure would be expected to increase with increased migration of contaminants present in soil and leachate to adjacent residential and commercial areas. Although there are no data on the concentrations of contaminants in surface soil in the vicinity of the site, some leachate contaminant concentrations (as summarized in Table 3-1) are relatively high. In addition, leachate seeps would be expected to continuously appear, evaporate, and/or run off-site in the vicinity of the landfill. A number of chemicals present in leachate (e.g., metals and PAHs) would be expected to adsorb onto soil particles and would subsequently remain in the soil after evaporation, or could be transported offsite by surface run-off of leachate. This process would result, over time, in gradually increasing concentrations of these contaminants in soil. Contact with landfill leachate or soil contaminated by leachate with subsequent incidental ingestion and dermal absorption of contaminants could potentially pose health risks, especially if exposure occurred regularly for extended periods of time. Individuals likely to be at greatest risk include: (1) persons regularly working outdoors (e.g., construction workers, gardeners) in the vicinity of leachate seeps or contaminated soil, (2) children playing outdoors in the vicinity of leachate seeps or contaminated soil, and (3) trespassers on the OII landfill site.

Inhalation of chemicals volatilized from the OII leachate (e.g., vinyl chloride and benzene, two human carcinogens for which ambient air monitoring data are available) could pose health risks to individuals if exposure were prolonged at relatively high chemical concentrations. For example, it can be estimated that ambient vinyl chloride and benzene concentrations of approximately 1 ppb and 0.6 ppb would each result in possible excess lifetime cancer risks of 10^{-6} (one in one million) by using the cancer potency factor for this compound and by assuming one's lifetime exposure occurs for only the 5 year period before final remediation of the OII landfill is completed. These values, calculated for a 70 kg individual with a breathing rate of 20 m^3/day, are less than some of the ambient air values reported for benzene and vinyl chloride in the vicinity of the OII landfill prior to upgrading the site control monitoring and leachate management procedures. Thus, while acute toxic hazards are unlikely to occur as a result of inhalation exposures, long-term exposures could pose other adverse health effects. It should be stressed that these calculations are presented for illustrative purposes only and that ambient air monitoring data are inadequate for a more thorough analysis at this time.

TABLE 3-3
POTENTIAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)
OII LANDFILL SITE

	Safe Drinking Water Act MCLs[a] (μg/l)	Safe Drinking Water Act MCLGs[b] (μg/l)	AWQC[c] (μg/l)	California Drinking Water Action Levels[d] (μg/l)
Acrylonitrile	—	—	0(0.063)	—
Ammonia	—	—	—	—
Arsenic	50	(50)	0(0.025)	—
Barium	1,000	(1,500)	—	—
Benzene	5	0	0(0.67)	0.7
Cadmium	10	(5)	10	—
1,2-Dichloroethane	5	0	0(0.94)	1
2,4-Dinitrololuene	—	—	0(0.11)	—
Hydrogen sulfide	—	—	—	—
Lead	50	(20)	50	—
Mercury	2	(3)	10	—
Phenol	—	—	3,500	1[e]
PCBs	—	(0)	0(0.0081)	—
PAHs	—	—	0(0.0031)	—
Selenium	10	(45)	10	—
Trichloroethylene	5	0	0(2.8)	5
Vinyl Chloride	2	0	0(2.0)	2

[a] Standards are primary MCLs, and are based on health-related considerations, and technological and economic feasibility of control.

[b] Proposed MCLGs, which are subject to change prior to final promulgation, are shown in parentheses.

[c] Values are adjusted for exposure through drinking water only. AWQCs for potential carcinogens are set at zero; values in parentheses are concentrations associated with 10^{-6} excess lifetime cancer risk.

[d] Drinking Water Action Levels Recommended by the Department of Health Services, State of California, 1987.

[e] For chlorinated systems; taste and odor threshold.

Inhalation of suspended soil particulates contaminated by landfill leachate also could potentially contribute to risk. It should be noted, however, that the extent of soil contamination and the degree of soil particulate reentrainment into ambient air are not known. It therefore is unclear if this route of exposure poses significant potential risks.

In the absence of leachate collection and treatment, contaminants from the OII landfill could potentially reach groundwater near the site. Groundwater in the vicinity of the OII site is believed to have significant use as a potable supply and is considered to be an important local resource. However, a full understanding of the hydrogeology of the area, hydrogeologic details regarding the aquifers in the area, and the susceptibility of the aquifers to degradation by contaminants from the OII landfill has not yet been gained. Contamination of groundwater contaminated at levels currently observed in leachate for the representative chemicals of concern would pose health risks to individuals using the water for domestic purposes as a result of exposure by ingestion, dermal contact, and inhalation. However, some dilution of the concentrations seen in leachate would be likely to occur as a result of dispersion and attenuation. Data to provide a quantitative estimate of potential health risks are not currently available.

Surface runoff of OII leachate to the local storm sewer system could potentially collect in the system and eventually migrate to surface water or groundwater. Depending on the degree of dilution or attenuation of site-related contaminants, exposure to leachate, surface water, or groundwater could pose health risks to individuals (e.g., local residents, sewer workers) as a result of direct contact, ingestion, or inhalation. However, data to provide a quantitative estimate of potential health risks are not currently available.

Without proper leachate management measures, the OII landfill could potentially have a number of adverse effects on welfare in the vicinity of the site. The occurrence of leachate seepage in the vicinity of the site would present an unsightly appearance and could adversely affect property values in the area. Contamination of groundwater also could adversely affect property values and would require the use of treatment systems or obtaining alternative water supplies for existing areas and for areas developed in the future.

Unpleasant odors emanate from the landfill and available air monitoring data support the likelihood that a number of organic chemicals may be present in air at levels greater than their corresponding odor thresholds. Increased buildup of leachate in the vicinity of the landfill and an increase of surface seepage could result in increased surface and subsurface emissions of volatile organic compounds. A number of these chemicals (e.g., hydrogen sulfide) could produce objectionable odors in the neighboring communities. Although concentrations of these types of compounds may not reach levels that would be likely to threaten human health, they may greatly reduce the desirable aesthetic characteristics of the surrounding area.

Environment. The absence of leachate management measures at the OII site would have objectionable aesthetic effects on the area in the vicinity of the landfill as noted in the section discussing risks to welfare. There currently is not sufficient information describing contamination of surface soil and leachate seeps to determine if the site would be likely to pose significant hazards to the local flora and fauna. However, other potential environmental impacts at the site are likely to be associated primarily with exposure to contaminated leachate and surface soil. Pets, other terrestrial animals, and birds may be exposed to contaminants present in surface materials and leachate. Bioaccumulation of some of the chemicals present in leachate (e.g., PCBs, PAHs, mercury), especially by soil invertebrates such as insects and earthworms, may occur. Other animals (e.g., higher predators) ingesting these organisms may also be exposed, thus leading to some bioconcentration in the food chain. In addition, contamination of groundwater and surface water in the vicinity of the site would constitute degradation of potentially important environmental resources.

In summary, the results of the preliminary endangerment assessment for the no-action alternative of the leachate management FS suggest that environmental media in the vicinity of the site could be degraded by OII leachate. Degradation could occur as a result of contaminant volatilization from leachate, direct contact of soil adjacent to the site with leachate seeps, percolation of leachate through soil to the underlying aquifer, and transport of leachate and leachate contaminated material to surface water via the storm sewer system. Failure to effectively manage leachate generated at the site could subsequently result in unacceptable adverse effects on public health, welfare, and the environment. Implementation of the no-action alternative could potentially result in relatively widespread environmental contamination and future remedial actions could become very costly or infeasible. Consequently, the no-action alternative was eliminated from further consideration due to public health and environmental concerns.

3.2.2 Off-Site Treatment

The off-site treatment alternative for the OII site involves the continued pumping of the Iguala wells, sumps and underground tanks to the above-ground storage tanks. Collected leachate is then pumped from the above-ground storage tanks by vacuum truck and is hauled to an off-site waste treatment facility where it is treated and disposed of into a local sanitary sewerage system. This is the leachate management alternative which has been used at the OII site since May 1985.

Off-site treatment of leachate at an acceptable facility is an effective leachate management alternative. Uncontrolled leachate flow from the OII site, the subsequent potential exposure of receptors to this hazardous substance, and the resulting adverse effects on public health, welfare, and the environment that could occur (as discussed in Section 3.2.1, "Endangerment Assessment for No-Action Alternative") would be prevented if the off-site treatment option were continued. Additionally, off-site leachate treatment provides a means of removing contaminants from a large volume of liquid and concentrating them into a smaller, more easily managed volume. A disadvantage of off-site treatment is that ultimate disposal of the concentrated contaminant as sludge, and spent carbon, cannot be closely monitored or as tightly controlled. Also, leachate spills could occur during loading and unloading of vacuum trucks, and during transport to the off-site facility. Hazards associated with isolated leachate spills could include health risks associated with exposure by inhalation, ingestion, and direct contact. However, implementation of appropriate emergency procedures could effectively minimize these potential risks.

The overall degree of effectiveness of the off-site treatment alternative depends largely upon the particular facility selected. Specific off-site treatment facilities were initially selected for evaluation based on their proximity to the OII landfill site. Proximity was chosen as a screening criterion based on the increased health and safety risks as well as the additional cost associated with longer leachate transport distances. Also considered was the RCRA compliance status of the facilities. EPA policy, based on a May 6, 1985 memorandum entitled "Procedures for Planning and Implementing Off-site Response Actions," is that no CERCLA hazardous substances will be taken off-site to an RCRA facility if the EPA Region determines that the facility has significant RCRA violations. Compliance of each facility with local industrial discharge regulations was also considered based on the premise that facilities which had significant discharge violations posed a greater risk to public health and the environment than those with no major violations.

Based on these screening criteria and cost, two existing off-site treatment facilities which would accept OII leachate, the Triple J Pacification Facility (ChemTech) located in Vernon, California, and the Oil Process Company (OPC) located in Los Angeles, California, were identified for further evaluation. Treatment at the ChemTech facility is the leachate management alternative used since May of 1985. Between October 1984 and January 1985, collected leachate was hauled off-site for deep injection well disposal (Rio Bravo) in Bakersfield, California. From January 1985 to May 1985 collected leachate was hauled to an off-site disposal facility (Casmalia).

Potential treatment of leachate at each of the two off-site facilities was evaluated. Both facilities consist of similar physical/chemical treatment process trains. Gravity separation of waste is followed by chemical coagulant addition and dissolved air flotation or sedimentation. These units will be, in the near future, followed by air stripping (ChemTech) or are currently followed by steam stripping (OPC) of volatile organics and activated carbon adsorption prior to discharge to a local sanitary sewerage system. Sludge generated during the treatment processes is dewatered prior to disposal at Kettleman Hills (ChemTech) or Casmalia (OPC). Both ChemTech and OPC are currently capable of treating waste volumes in the range of 25 to 50 thousand gallons of waste per day of varying quality. Segregation of waste types is practiced to maximize treatment efficiency. Although the overall treatment systems are fairly complex when compared to municipal waste treatment processes, automation and ease of operation has been emphasized.

Both facilities currently possess and are currently in compliance with their RCRA permits and are permitted by local authorities to discharge treated effluent on a batch basis to local sanitary sewerage systems after characterization. The Los Angeles County Sanitation District has regulated the discharge from ChemTech since early 1985 and the city of Los Angeles Bureau of Sanitation has regulated the discharge from the Oil Process Company facility since early 1986. Regulatory officials and plant operators indicate only minor violations have occurred. OPC shut down to make treatment modifications for approximately two months shortly after initial start-up on March 27, 1986, due to noncompliance with discharge limits.

Off-site treatment of OII leachate at either facility is currently an available option. As stated previously, leachate from the OII site is currently hauled to the ChemTech facility for treatment and disposal. The cost of leachate hauling, treatment and disposal as quoted by management officials at each facility ranges from $0.34 per gallon at the ChemTech plant to an estimate of $0.54 per gallon at the OPC plant.

Based on an evaluation of off-site treatment of OII leachate, it was determined that this option would be an effective leachate management alternative. This alternative adequately protects public health, welfare, and the environment and acts in significantly reducing the overall volume of hazardous substances at the site. Two existing off-site facilities, ChemTech and OPC, were chosen for further evaluation in that they provide protection to public health, welfare, and the environment, have reasonable costs, and are in compliance with RCRA and local sanitary district regulations and due to their proximity to the OII site.

3.2.3 Off-Site Disposal

The off-site disposal alternative for the OII site involves the continued pumping of the Iguala Wells, sumps and underground tanks to the aboveground storage tanks. Collected leachate is then pumped from the above- ground storage tanks by vacuum truck and is hauled to an off-site RCRA disposal facility.

Hauling and disposing of leachate collected at the OII landfill site to an approved RCRA landfill was considered to be a potentially acceptable remedial measure. EPA policy, based on a May 6, 1985 memorandum entitled "Procedures for Planning and Implementing Off-site Response Actions," states that no CERCLA hazardous substances will be taken off-site to a RCRA facility if the EPA Region determines that the facility has significant RCRA violations.

Several RCRA regulated disposal facilities exist in the western United States, including the Chemical Waste Management facility at Kettleman Hills in Kettleman City, California, and the USPCI facility in Murray, Utah. The Kettleman Hills facility cannot currently accept liquid hazardous wastes from the OII site, whereas the USPCI facility could accept OII leachate. Both facilities presently allow disposal of other liquid wastes into doubled lined surface impoundments. The 1986 cost for disposal of leachate at these facilities ranges from $0.65 to more than $1.00 per gallon.

Several major disadvantages to the use of these alternative land disposal facilities for OII leachate disposal exists. One disadvantage is the distance to the sites. The Kettleman Hills facility is the closest RCRA disposal site, being over 200 miles away from the OII landfill. The Utah facility which is the closest RCRA site in full compliance and is located approximately 700 miles away. The distance factor contributes to the cost of disposal. Transportation costs for hauling to Kettleman Hills are estimated at $0.15 to $0.20 per gallon, based upon a portal-to-portal distance of 420 miles, and a 12-hour trip.

The collection and hauling of leachate to a RCRA disposal facility results in improved protection of public health, welfare, and the environment in the vicinity of the OII site in comparison to the no-action alternative by presenting uncontrolled surface and subsurface seepage of leachate from the OII landfill to adjacent environmental media and neighboring communities. Under this alternative, leachate spills also could occur during loading and unloading of vacuum trucks, and during transport to the off-site disposal facility. However, it is likely that risks associated with infrequent releases of this type could be minimized by implementing appropriate emergency procedures. Nevertheless, off-site land disposal is not a preferred method for management of CERCLA hazardous substances. The recently passed Superfund Amendments and Reauthorization Act (SARA) establishes a preference for remedies which permanently and significantly reduce the mobility, toxicity or volume of wastes (permanency); SARA considers land disposal the least preferred alternative. Additionally, a recently adopted EPA policy for Superfund response actions involving the off-site storage, treatment, or disposal of CERCLA hazardous substances establishes a preference for response actions that use treatment, reuse or recycling rather than land disposal. New EPA land disposal policy prohibits land disposal of dioxins and solvents and other hazardous wastes will be included under this policy in the future. Thus, off-site disposal of free liquids may not be possible over the long-term.

The disposal of leachate collected from the OII landfill site at an off-site RCRA disposal facility was eliminated from further consideration as a viable remedial alternative. The cost of this alternative exceeds the costs of other alternatives evaluated without providing greater protection of public health, welfare, and the environment. Additionally, this alternative is the least preferred option due to its lack of permanency. Because the mobility, toxicity, and volume of leachate would not necessarily be reduced, implementation of this alternative could potentially pose risks to public health, welfare, and the environment in the future in the vicinity of the disposal site.

3.2.4 On-Site Disposal

The on-site disposal alternative for the OII site involves the continued pumping of the Iguala wells, sumps, and underground tanks to the above-ground storage tanks. Collected leachate is then pumped to on-site surface impoundments.

Although the collection and disposal of leachate in on-site surface impoundments may result in improved protection of public health, welfare, and the environment when compared to the no action alternative because uncontrolled leachate seepage would be prevented, on-site disposal will not adequately protect public health and is not a preferred leachate management alternative. Although evaporation from the impoundments would reduce the volume of liquid leachate, many hazardous constituents would not be captured for proper disposal. Volatile organic constituents present in the leachate such as benzene, ethyl benzene, toluene, dichlorobenzenes, vinyl chloride, dichloroethane and methylene chloride would be expected to pass into the atmosphere, degrade ambient air in the vicinity of the site, and pose a potential health threat to nearby communities. Additionally, there is a proposed California state regulation forbidding the disposal of untreated hazardous wastes into evaporation ponds. The on-site disposal of untreated liquids from the OII site would not be possible after promulgation of this regulation.

The disposal of leachate collected from the OII site in on-site surface impoundments was eliminated from further consideration as a leachate management alternative. This alternative was deemed ineffective due to potential public health concerns, primarily as a result of exposure by inhalation, and its least preferred status under SARA and EPA policies, which reflect public health concerns. Because the mobility of leachate would not necessarily be reduced, implementation of this alternative could potentially pose risks to public health, welfare, and the environment in the future in the vicinity of the OII site.

3.2.5 On-Site Treatment

The on-site treatment alternative for the OII site involves the continued pumping of the Iguala wells, sumps, and underground tanks to the above-ground storage tanks. Collected leachate would be treated in an on-site waste treatment facility and disposed of into the Los Angeles County Sanitation District sanitary sewerage system.

On-site treatment of leachate in a properly designed and operated treatment facility is an effective leachate management alternative. Specific treatment process trains can be configured to remove many contaminants and thereby provide maximum protection of public health and the environment and compliance with established policies. In addition, flexibility can be designed into an on-site treatment facility so that treatment can be modified, as needed, to adjust to changing leachate quality or quantity.

The overall effectiveness of the on-site treatment option depends on the specific processes of the treatment alternative chosen. Several on-site physical/chemical treatment alternatives were developed from the screened technologies. These were reviewed to assess their feasibility for treating OII landfill leachate and to assess their effectiveness with respect to protection of public health and the environment, and cost. As stated earlier, only proven technologies were considered for formulation of treatment process trains. These processes include gravity separation and dissolved air flotation for oil and grease removal, air stripping and activated carbon for organic pollutant removal, air stripping for sulfide reduction and reverse-osmosis for reduction of total dissolved solids. Special consideration was given to unit processes which could accomplish a dual function in addressing the removal of critical pollutants from OII leachate. This would increase operational efficiency, decrease cost, and allow greater flexibility of the treatment process to treat varying qualities of leachate.

Different treatment alternatives were developed which attain and exceed applicable or relevant and appropriate requirements, or provide similar levels of protection. Alternatives developed include: (1) gravity separation with sewering of effluent; (2) gravity separation followed by coagulant addition, dissolved air flotation, filtration, and air stripping, with vapor phase carbon adsorption, with sewering of effluent; (3) gravity separation followed by coagulant addition, dissolved air flotation, filtration and activated carbon, with effluent sewering; (4) gravity separation followed by coagulant addition, dissolved air flotation, filtration, air stripping without off-gas treatment and activated carbon, with sewering of effluent; (5) gravity separation followed by coagulant addition, dissolved air flotation, filtration, air stripping with vapor phase carbon adsorption, and activated carbon with sewering of effluent; and (6), same as (5) with addition of ultrafiltration and reverse osmosis, with sewering and/or reuse of effluent. Each alternative was subsequently screened using the criteria presented at the beginning of this chapter. A detailed description of each alternative which passed this screening process is presented in Chapter 4.

On-Site Alternative 1

The first treatment alternative was developed as a minimal treatment process, and included gravity separation or clarification, with discharge of effluent to the LACSD sanitary sewerage system. The process was proposed to remove oils and greases from the leachate with some solids separation occurring as well. The unit chosen was a prepackaged, corrugated plate coalescing separator with a minimum hydraulic retention time of 40 minutes. Grease and oil would be skimmed to a storage tank and sludge would be pumped to a holding tank for thickening and proper disposal to a permitted landfill. Clarified leachate would be pumped or would flow by gravity to the LACSD sewer system. Proximate sewer locations for five alternative treatment plant locations are identified in Figure G-1. This process would be simple, easily implemented, and inexpensive to construct and operate. Although this alternative would improve the protection of public health, welfare, and the environment, when compared to the no action alternative (Section 3.2.1), adequate reduction of potential risks may not be provided. On-site Alternative 1 would function in removing oil and grease, organic constituents solubilized in the oily fraction, and insoluble constituents but would not effectively remove soluble heavy metals, sulfides, cyanides or water soluble organic constituents. The toxic effects of a number of the leachate constituents that would not be removed are discussed in Section 3.2.1, "Endangerment Assessment for No-Action Alternative". These remaining constituents could constitute a threat to public health, welfare, and the environment after they were discharged to the sanitary sewerage system. Organic substances with a high vapor pressure could volatilize and build up in sewer systems to create a hazard for sewer maintenance personnel. Vapors could also be released through manholes. Additionally, many contaminants, although significantly diluted by domestic wastes after discharge to the sanitary sewer system, could pass through the regional domestic wastewater treatment facility and contaminate receiving waters.

On-site treatment Alternative 1 also does not appear to be a preferred alternative for the management of leachate from the OII site, based on permanency. Since on-site Alternative 1 is not designed to remove organic contaminants and soluble heavy metals, there is no significant and permanent reduction in the toxicity, mobility, or volume of these pollutants during the treatment process. Pollutants are discharged to the sanitary sewerage system where they are diluted. Furthermore, if these materials are not sufficiently diluted, they could then potentially pose risks to health, welfare, or the environment in the future and at locations away from the OII site.

Although on-site treatment Alternative 1 results in improved management of leachate from the OII site, in comparison with the no action alternative, this alternative does not appear to provide an adequate level of protection of public health, welfare, and the environment. In addition, because this alternative does not significantly and permanently reduce the toxicity, mobility, or volume of many pollutants, it is not a preferred alternative under SARA. Therefore, on-site treatment Alternative 1 was screened from further consideration.

On-Site Alternative 2

The second on-site treatment alternative consisted of Alternative 1 with the addition of a rapid mix unit, a solid/liquid separation system, rapid sand filtration, air stripping, and off-gas treatment. A coagulant would be added in the rapid mix unit and the coagulated materials would be skimmed off or settled out in the solid/liquid dissolved air flotation separation system. Additional solids would be removed by rapid sand filtration. Air stripping, incorporating a vapor phase carbon adsorption system would be employed for sulfide and organic pollutant removal. Effluent from this facility would be sewered to the LACSD system.

This system would provide better protection of public health, welfare, and the environment than Alternative 1. Emulsified oil and grease, solids and heavy metals would be removed, utilizing the rapid mix coagulant addition, dissolved air flotation and filtration. Sulfides and volatile organic compounds would be removed from the liquid phase in the air stripping column and captured by the vapor phase carbon adsorption column. The effectiveness of this system in removing toxic constituents prior to discharge would be dependent on raw leachate quality and the fraction of strippable toxic organics. Semi-volatile constituents might not be adequately removed by this system. This alternative provides a means of concentrating and capturing volatile toxic constituents present in the leachate thus allowing for a permanent and significant reduction in their toxicity, mobility, and volume. Therefore, on-site treatment Alternative 2 appears to be a preferred alternative under SARA and could effectively contribute to protecting public health. On-site Alternative 2 was considered a viable option for further consideration.

On-Site Alternative 3

The third on-site treatment alternative consisted of Alternative 2 with the air stripping and vapor phase carbon adsorption off-gas treatment unit processes replaced by a liquid phase granular activated carbon adsorption system for toxic organic constituent removal. Effluent from this system would be discharged to LACSD sewers.

This treatment plant alternative is considered to be comparable to or slightly better than Alternative 2 in providing adequate protection of public health, welfare, and the environment. Sorbable organic constituents would be removed from the liquid leachate in the carbon towers. This configuration might not be as effective as Alternative 2 in removing low molecular weight volatile organics, but would be more effective in the removal of semi-volatile sorbable constituents.

Alternative 3 provides a means of concentrating and capturing toxic constituents present in the liquid leachate on a solid sorbant. The pollutants are thus largely immobilized and the volume is reduced. This alternative appears to be a preferred alternative under SARA and could effectively contribute to protecting public health. On-site treatment Alternative 3 was considered an alternative which should be evaluated in detail.

On-Site Alternative 4

The fourth on-site treatment alternative was formulated by combining some components of Alternatives 2 and 3. It consisted of the same gravity separation, rapid mix coagulant addition, dissolved air flotation and filtration process train followed by air stripping without off-gas treatment and granular activated carbon adsorption with sewering of effluent.

Alternative 4 would be the most reliable of the first four on-site alternatives in producing the cleanest effluent. Highly volatile toxic organics present in the OII leachate would be removed in the air stripping column with other sorbable toxic organics removal by activated carbon adsorption. This alternative would provide good overall total toxic organic and sulfide removal, as well as oil and grease and metal removal, plus it would allow for more effective use of the activated carbon than Alternative 3 and thus lower carbon replacement costs.

The disadvantage of on-site treatment Alternative 4, is its the failure to treat off-gas from the air stripping tower. Toxic volatile organics stripped from the liquid phase to the gas phase should be removed from the gas phase in order to effectively reduce odors, protect public health, and significantly reduce the toxicity, mobility, and volume of the wastes in accordance with SARA. Transferring hazardous substances from the liquid to gas phase is not a permanent method of reducing the toxicity or mobility of these pollutants. Therefore, Alternative 4 has been eliminated from further consideration on the basis of lack of permanency and potential contribution to public health problems.

On-Site Alternative 5

On-site leachate treatment Alternative 5 consisted of the same unit processes as presented in Alternative 4 with the addition of a vapor phase carbon adsorption system. This system provided for improved protection of public health over Alternative 4 by capturing toxic constituents present in off-gases from the air stripping tower. Alternative 5 also provided a better degree of permanence than Alternative 4 in that the mobility of the stripped toxic pollutants was significantly and permanently reduced, due to capture in the vapor phase carbon adsorption column. Therefore, on-site treatment Alternative 5 was considered for further evaluation.

On-Site Alternative 6

The sixth on-site treatment alternative was identified specifically to exceed applicable or relevant and appropriate standards. This remedial alternative consists of the system presented in Alternative 5 with additional treatment to remove total dissolved solids (TDS). This system was designed to provide effluent of irrigation reuse quality, and thus would exceed LACSD discharge standards.

TDS removal, necessary for reuse, will be accomplished using an ultrafiltration/reverse osmosis (UF/RO) desalination system. Ultrafiltration was provided as pretreatment for the reverse osmosis unit to reduce membrane fouling. A detailed description of the UF/RO system is presented in Section 4.2.1. High TDS brine resulting from the treatment process would be disposed of to the sanitary sewerage system.

On-site treatment Alternative 6 is considered to be an innovative leachate management alternative which provides protection of pubic health, welfare, and the environment and which complies with SARA. Therefore, this alternative was deemed to warrant further analysis. Although costs would be higher for this option than other on-site treatment alternatives evaluated, a preliminary estimate of costs indicated that increased costs would not greatly exceed costs for other on-site alternatives and this would not necessitate rejection on a cost basis.

3.2.6 Summary of Alternative Screening

Initial screening of remedial action alternatives to manage OII leachate was performed to eliminate alternatives which were not effective in protecting public health, welfare, and the environment, did not follow established EPA policies, and did not permanently and significantly reduce the mobility, toxicity or volume of hazardous substances. Of the ten proposed, five alternatives were eliminated based on these considerations. None of the ten alternatives was deemed significantly more costly than other viable alternatives.

Various off-site and on-site treatment and disposal alternatives were reviewed. Off-site treatment and four of the six on-site treatment alternatives were found to be acceptable, based on the previously referenced selection criteria. These were selected to undergo further analysis. Both off- and on-site disposal alternatives were eliminated from consideration after review. Table 3-4 presents a summary of the screening process performed on the proposed remedial alternatives for the management of the OII landfill leachate.

TABLE 3-4

SUMMARY OF INITIAL SCREENING OF ALTERNATIVES

Alternative	Results of Initial Screening	Reason for Elimination
No Action	Eliminated	Potential adverse public health and environmental effects
Off-site treatment	Consider further	———
Off-site disposal	Eliminated	Potential adverse public health effects, EPA policy, permanency, cost
On-site disposal	Eliminated	Potential adverse public health effects, permanency
On-site treatment		
Alt.1 - Gravity separation sewer disposal	Eliminated	Potential adverse health and environmental effects, permanency
Alt.2 - Gravity separation, coagulation addition, DAF, filtration, air stripping with off-gas treatment sewer disposal	Consider further	———
Alt.3 - Same as Alt.2 with GAC replacing air stripping/off-gas treatment	Consider further	———
Alt.4 - Same as Alt.3 with air stripping without off-gas treatment added prior to GAC	Eliminated	Potential adverse health effects, permanency
Alt.5 - Same as Alt.4 with off-gas treatment added	Consider further	———
Alt.6 - Same as Alt.5 with UF/RO added and reuse of effluent	Consider further	———

4.0 DETAILED ANALYSIS OF SELECTED REMEDIAL ACTION ALTERNATIVES

This section presents a detailed evaluation of the five alternatives that remain after the initial screening described in Section 3.

The alternatives selected for further analyses include:

- Off-site treatment
  - Off-site treatment at a permitted facility
- On-site treatment
  - Gravity separation--> DAF--> filtration--> air stripping with off-gas treatment--> effluent disposal to LACSD. (On-site Alternative 2)
  - Gravity separation--> DAF--> filtration--> activated carbon--> effluent disposal to LACSD. (On-site Alternative 3)
  - Gravity separation--> DAF--> filtration--> air stripping with off-gas treatment--> activated carbon--> effluent disposal to LACSD. (On-site Alternative 5)
  - Gravity separation--> DAF--> filtration --> air stripping with off-gas treatment--> activated carbon--> ultrafiltration--> reverse osmosis--> reuse of effluent for irrigation or discharge to LACSD. (On-site Alternative 6)

The ability of the remedies specified under each alternative to protect human health, welfare, and the environment are evaluated in the context of engineering performance and reliability. The detailed analysis of each alternative includes an evaluation based on non-cost factors followed by an evaluation based on cost. Non-cost criteria examined for each alternative include the following:

- Technical considerations. A refinement and description of the alternative in detail, with emphasis on the use of established technology, is provided. Criteria examined include the expected performance, reliability and implementability of the alternative.
- Safety and public health protection. A discussion and assessment of the safety and public health concerns of the alternative is provided.

- Institutional requirements. A discussion of the institutional requirements which would apply to the alternative is presented.
- Environmental impacts. Possible adverse environmental impacts which could result from implementing the alternative are discussed.

A detailed cost analysis, including operation and maintenance cost and distribution of costs over time is present in Secton 4.3.

4.1 OFF-SITE TREATMENT OF LEACHATE

4.1.1 TECHNICAL DISCUSSION OF OFF-SITE TREATMENT

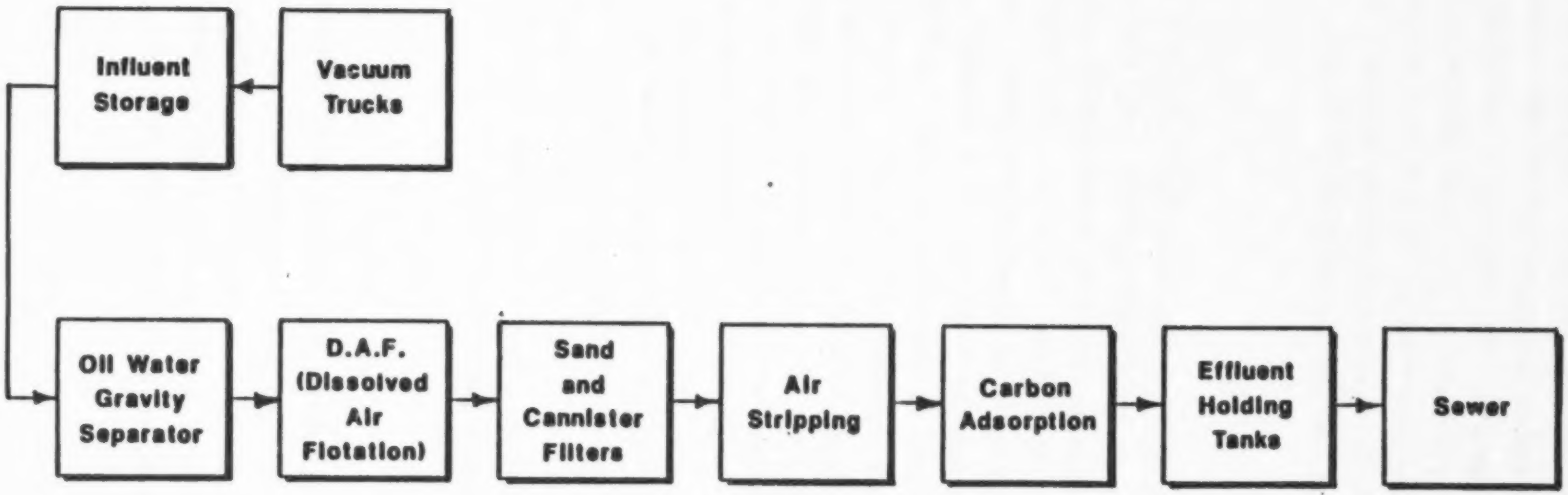
Description

Off-site treatment is the method currently being used to manage the leachate generated at the OII landfill. Leachate is pumped on a daily basis from the underground collection tanks to the above ground Baker storage tanks. The leachate is periodically pumped from the storage tanks and hauled to an off-site treatment plant where it is batch-treated and the effluent disposed of in the LACSD sewer system. There are two off-site treatment facilities in Southern California that are permitted and capable of treating the leachate:

- ChemTech; Vernon, California
- Oil Process Company; Los Angeles, California

The operation of the ChemTech plant, which is currently treating the leachate from the OII facility, is described below.

The ChemTech treatment process train (Figure 4-1) begins with the plate separator where gravity separation of oil, water, and solids occurs. The leachate then enters a chemical mixing tank where alum (48% aluminum sulfate) is added under pH control (near neutrality). Oil and suspended solids are subsequently removed in the presence of polymer as floc in the dissolved air flotation (DAF) tank. Pinpoint floc not skimmed in the DAF


Influent Storage
Vacuum Trucks
Oil Water Gravity Separator
D.A.F. (Dissolved Air Flotation)
Sand and Cannister Filters
Air Stripping
Carbon Adsorption
Effluent Holding Tanks
Sewer

Project No.	Oil Industries Landfill	CHEMTECH LEACHATE TREATMENT PROCESS	Figure
120-RI2	Camp Dresser & McKee Inc.		4-1

tank is removed by sand and canister filters. Clarified, de-oiled leachate subsequently passes into granular activated carbon (GAC) adsorption towers for removal of dissolved organics. The facility is currently adding an air stripping tower to the process train prior to GAC adsorption in order to reduce carbon usage. Sludge generated in the DAF tank and plate separator is routed to a filter press for dewatering before disposal at a RCRA landfill. Design flow rates are in the range of 50-70 gpm.

Performance

It is estimated that since April, 1985, more than 3 million gallons of OII leachate have been treated at the ChemTech plant. The effluent is batched and tested prior to discharge to the LACSD sewer system. If the effluent meets the LACSD discharge limitations (listed in Table 2-2) and the permit conditions are met, the effluent is pumped to the sewer. If the conditions are not met, further treatment is required. In a November, 1986, discussion with staff at the LACSD, it was indicated that the ChemTech processes have been effective for the treatment of leachate. During early June 1985, EPA consultants Woodward-Clyde Consultants (WCC) conducted a treatability test at the ChemTech Treatment facility. Samples were taken of the raw leachate, the treated leachate effluent and at a point in the process between the sand filtration and the carbon adsorption units. Altogether five samples of raw leachate, five samples of effluent and four "in-process" samples were tested. The oil and grease was the only parameter that exceeded the LACSD discharge limitation. The oil and grease content was measured by WCC at 30-50 mg/l. The LACSD discharge limit is 10 mg/l, however, the LACSD stated that the ChemTech effluent normally meets the oil and grease discharge limit of 10 mg/l.

Reliability

All of the processes utilized in the various units comprising the plant are commonly used in industry. Further, they have been used at other leachate treatment facilities. Operation of the ChemTech treatment facility is not complex, operates by partial automation, and has low maintenance requirements. Off-site treatment at the ChemTech facility will remain viable as long as the plant is approved to treat OII leachate and can provide uninterrupted service. The ChemTech facility, as a private enterprise, can cease operation at any time, especially if it becomes unprofitable. In addition, if regulations are violated, this option could not be continued. An alternative off-site treatment facility would have to be used. Off-site treatment might then require excessive haul distances and associated increases in cost and risk. Off-site treatment therefore, is of questionable reliability.

Implementability

The ChemTech facility is already treating OII landfill leachate, therefore it can be implemented immediately.

4.1.2 SAFETY AND PUBLIC HEALTH PROTECTION

Operation of the ChemTech facility itself does not pose a major threat to the health and safety of the community. Leachate is trucked seven miles from the landfill to the treatment plant. Adverse public health, welfare, and environmental impacts could occur in the case of an accident on the trip to the treatment plant. Statistics are not available on the probability of an accident occurring on the route the tanker trucks would take. Due to the short haul distance to the ChemTech facility and the low hauling frequency, there is a small probability of an accident involving leachate spillage. Overall accident statistics from the U.S. Department of Transportation (1982) indicate some 451 accidents occur per one hundred million vehicle miles. It has been estimated that in tanker truck accidents, 53 percent result in spillage of the contents (1981 California Highway Patrol statistics). (This would place the probability of an accident with a spill at greater than 1 percent per year.) Tanker spillage along this route could result in exposure of the public to toxic chemicals via direct contact with leachate as well as via contact with leachate contaminated soils, surface water, and groundwater, and via inhalation of volatile organic emissions. Short-term, one time exposures to leachate following a transportation accident are not likely to pose significant health risks, especially if appropriate emergency response actions are implemented.

Leachate is loaded into tank trucks on the OII site by means of a vacuum pumping system. Under this type of loading system, neither leachate nor odors are likely to escape. However, experience has shown that this activity poses the greatest risk of a spill during transport of leachate. The vacuum pumping station would be a special area of the OII site designed to contain any spill that would occur if a hose or valve failed. Any spillage would be removed to prevent exposure and associated risks to the nearby residential areas. A Spill Prevention, Control and Countermeasure Plan (SPCC) would be developed for the site. The SPCC could not address any failures in the vacuum truck equipment which could cause leakage during transport.

Public health risk resulting from a 5,000 gallon spill of leachate is difficult to assess. It would depend on the nature and location of the accident. The leachate is not highly volatile, and it is anticipated that any major health effects of a spill would result mainly from direct contact. In addition, it should be noted that in all situations where contaminated materials are removed from a site and treated, stored, or disposed at a RCRA-permitted facility, it is not necessary to include the RCRA facility as a source of chemical release to the environment for purposes of remedial alternative assessment. Potential releases during transport of wastes from the site to the RCRA facility also need not be considered (EPA 1986a). Consequently, only spills during transfer of leachate at the OII site need be considered explicitly for this assessment. As noted above, development and implementation of an SPCC Plan for the site would minimize potential risks to public health in the vicinity of the site.

4.1.3 INSTITUTIONAL REQUIREMENTS

ChemTech Systems Inc. is presently permitted to accept and treat leachate from the OII landfill at its treatment plant. ChemTech has an industrial discharge permit to discharge to the LACSD sewer on a batch basis. The batched treatment plant effluent must meet LACSD discharge requirements prior to release into the sewer system. The plant operation currently meets the requirements of the SCAQMD and federal and state requirements under the Resource Conservation and Recovery Act.

4.1.4 ENVIRONMENTAL IMPACTS

Off-site treatment would reduce the volume of leachate at the OII site and consequently reduce the risk of leachate contamination of the environment.

Possible adverse impacts are similar as those discussed in the public health section. If a spill occurred as the result of an accident, some environmental damage may occur, depending on the nature and location of the accident, the proximity to sensitive environmental receptors, and the environmental fate and transport of leachate contaminants in the vicinity of the spill. A spill which could occur at the OII site during truck loading activities is expected to be contained within the site boundaries by virture of the SPCC plan for the site and thus would be expected to cause only minimal additional adverse environmental impacts. A major spill of leachate on the highway along the route to ChemTech could potentially cause environmental damage. Although the trucking route to ChemTech does not pass any waterways, a major spill of 5,000 gallons of raw leachate on the highway in specific areas could probably not be completely contained before a portion of the spill entered the storm drainage system with potential for contaminating surface waters. The trucking route passes over major storm drains tributary to both the Los Angeles River and the Rio Hondo Coastal Basin Spreading Grounds. The Pomona Freeway, west of OII to Atlantic Boulevard, passes over six channel tributaries to the Rio Hondo. Additionally, west of Atlantic Boulevard, the Pomona and Long Beach Freeways pass over many channels tributary to the Los Angeles River. These channels are primarily underground with limited access and have no flow control systems in their design. A SPCC plan which would be developed if this alternative were selected, would include response actions to be undertaken in order to minimize any environmental impacts which could occur if a spill at the site or along the trucking route to the off-site facility. As noted above, however, potential releases during transport of leachate from the OII site to the off-site RCRA treatment facility need not be considered in this assessment of remedial alternatives.

4.1.5 ALTERNATE OFF-SITE TREATMENT AT OIL PROCESS COMPANY

Oil Process Company (OPC) operates an industrial liquid waste treatment facility in Los Angeles. OPC operates as a RCRA approved facility under a Part B permit issued by California DOHS. The facility is permitted for industrial discharge by the Los Angeles Bureau of Sanitation. Sludge generated at the treatment facility is hauled to Casmalia for disposal.

The process treatment of liquid wastes is similar to the ChemTech facility and consists of coagulation, sedimentation, gravity separation, DAF, steam stripping and activated carbon. OPC will accept leachate from the OII landfill site.

The evaluation of technical feasibility, safety, institutional compliance, public health and environmental impacts is similar to the evaluation for the ChemTech facility. The haul route would be about 3 miles longer and would cross the Los Angeles River. The SPCC plan developed for the alternative would address spill response actions to minimize environmental impacts in case of an accident, however, prevention of direct contact with the leachate and prevention of surface and groundwater contamination could not be ensured.

Future off-site treatment of OII leachate will be determined by competitive bidding from approved waste treatment facilities.

4.2 ON-SITE TREATMENT OF LEACHATE

4.2.1 TECHNICAL DISCUSSION OF ON-SITE TREATMENT

The on-site treatment alternative for managing OII landfill leachate involves the construction and operation of a leachate treatment facility at the landfill site. The following four alternative treatment plant configurations were evaluated for treatment of the leachate:

Process Train #1

Gravity separation —> coagulant addition —> dissolved air flotation —> filtration —> air stripping with vapor phase carbon adsorption ... discharge (On-site Alternative 2)

Process Train #2

Gravity separation —> coagulant addition —> dissolved air flotation —> filtration —> liquid phase granular activated carbon adsorption ... discharge (On-site Alternative 3)

Process Train #3

Gravity separation —> coagulant addition —> dissolved air flotation —> filtration —> air stripping with vapor phase carbon adsorption —> liquid phase granular activated carbon adsorption ... discharge (On-site Alternative 5)

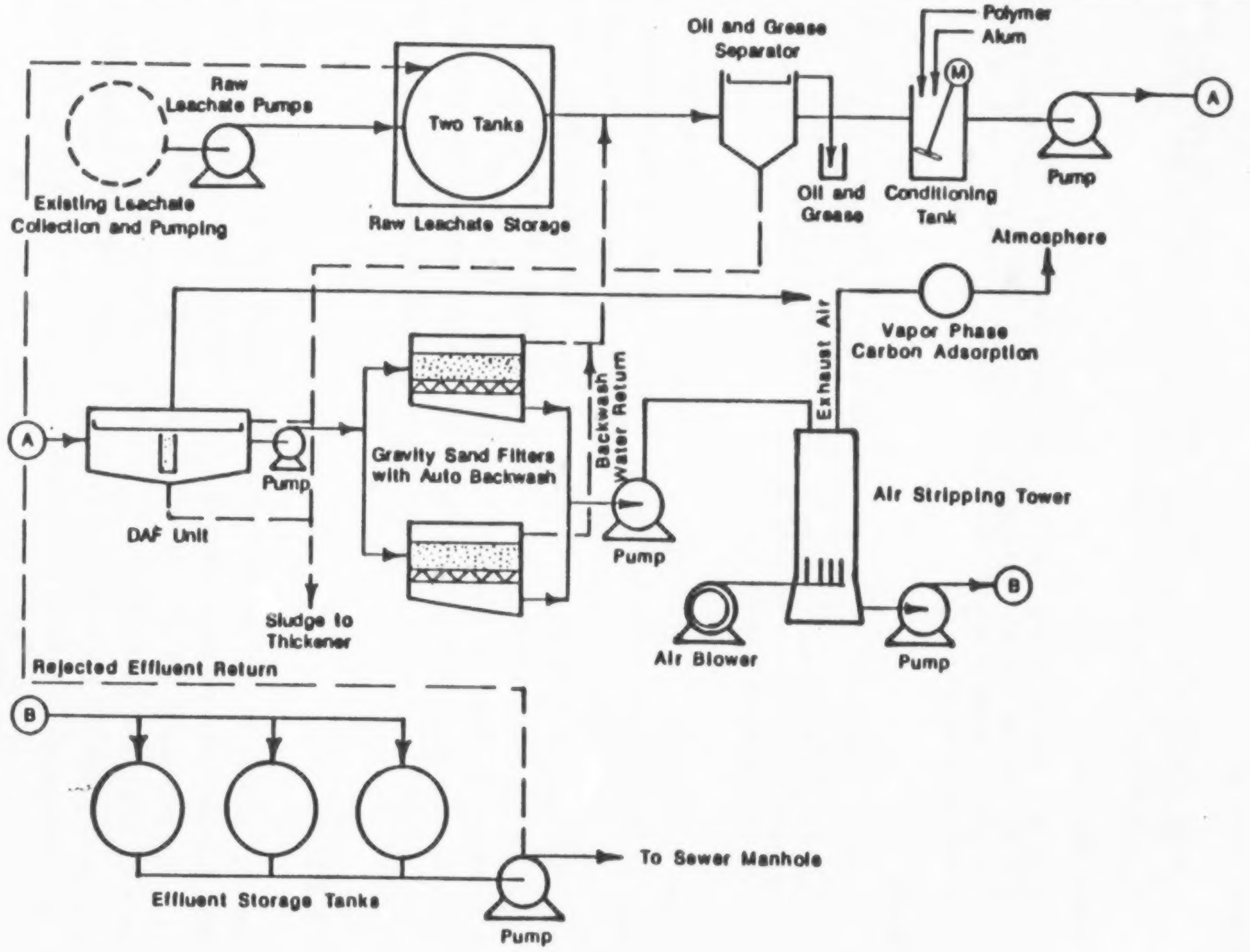
Process Train #4

Gravity separation —> coagulant addition —> dissolved air flotation —> filtration —> air stripping with vapor phase carbon adsorption —> liquid phase granular activated carbon adsorption —> ultra-filtration —> reverse osmosis ... reuse and/or discharge (On-site Alternative 6)

In addition to evaluating, in detail, the effectiveness and associated costs of each of the above-referenced treatment alternatives, four possible locations for siting the treatment facility at or adjacent to the landfill were evaluated to determine the effect of plant location on cost, consistency with the final remedy, and other public health and safety factors. This analysis, which is included as Appendix G, illustrates that minor differences in capital and present worth costs exist between the four siting alternatives. A fifth siting alternative is also presented in Appendix A.

Description

The unit processes for removal of oil and grease and heavy metals are the same for the four on-site treatment alternatives (Alternatives 2, 3, 5, and 6). The processes for the removal of the organic compounds vary between on-site treatment Alternatives 2, 3, and 5. A schematic of the Alternative 2 process train is shown in Figure 4-2. Without granular activated carbon (GAC) adsorption following air stripping, it is unlikely that the treated


Raw
Leachate Pumps
Existing Leachate
Collection and Pumping
Two Tanks
Raw Leachate Storage
Oil and Grease
Separator
Oil and
Grease
Polymer
Alum
M
Conditioning
Tank
Pump
A
Atmosphere
Vapor Phase
Carbon Adsorption
Exhaust Air
A
DAF Unit
Pump
Gravity Sand Filters
with Auto Backwash
Backwash
Water Return
Pump
Air Stripping Tower
Air Blower
Pump
B
Sludge to
Thickener
Rejected Effluent Return
B
Effluent Storage Tanks
Pump
To Sewer Manhole

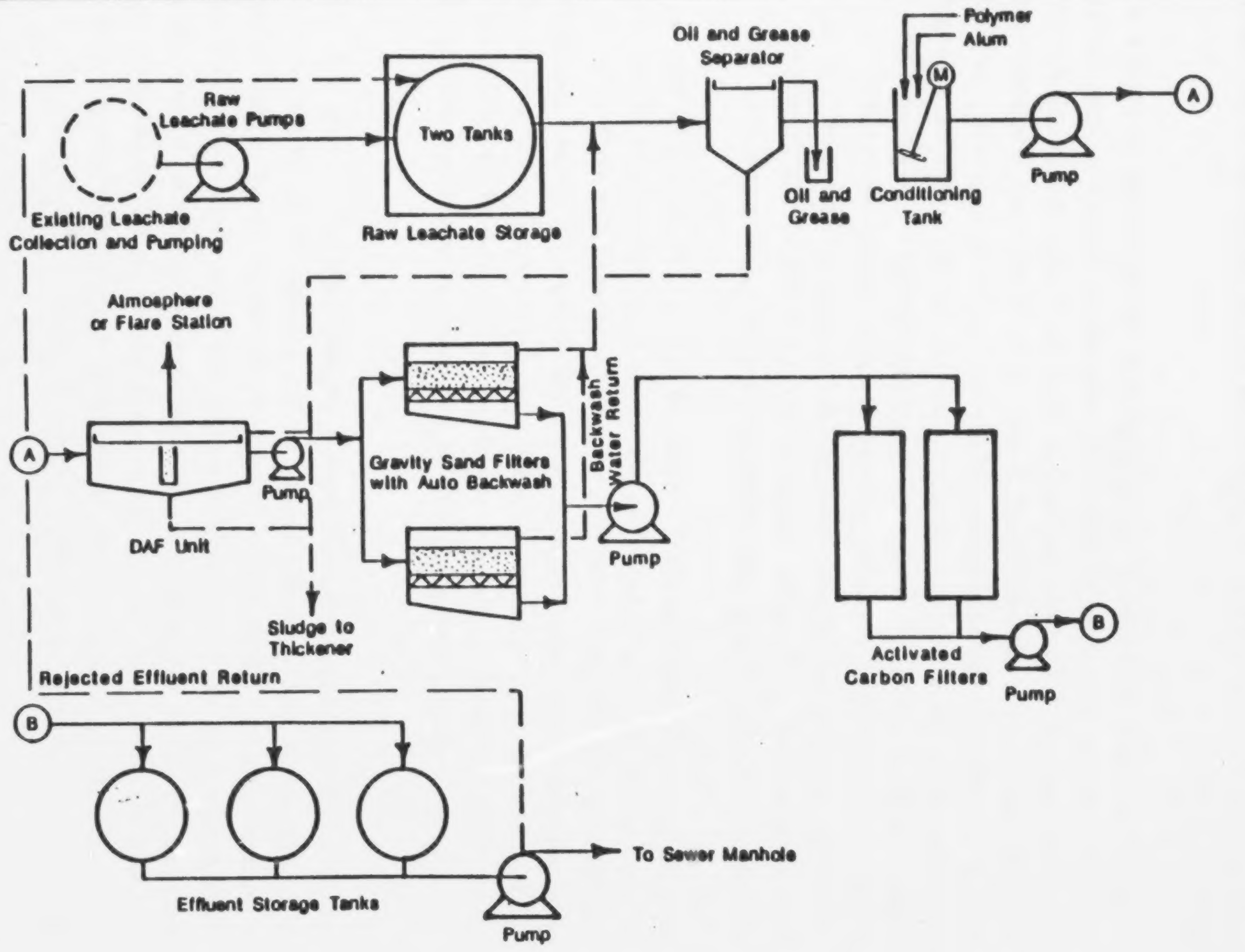
Project No.	Oil Industries Landfill	ALTERNATIVE 2 TREATMENT	Figure
120-RI2	Camp Dress & McKee Inc.	PLANT PROCESS TRAIN	4-2

leachate would consistently meet the requirements for total toxic organic removal needed for an off-site wastewater discharge permit (considered an ARAR). Even so, this alternative reduces the threat from the hazardous leachate and provides significantly increased protection of public health, welfare, and the environment in comparison to the no-action alternative (Section 3.2.1).

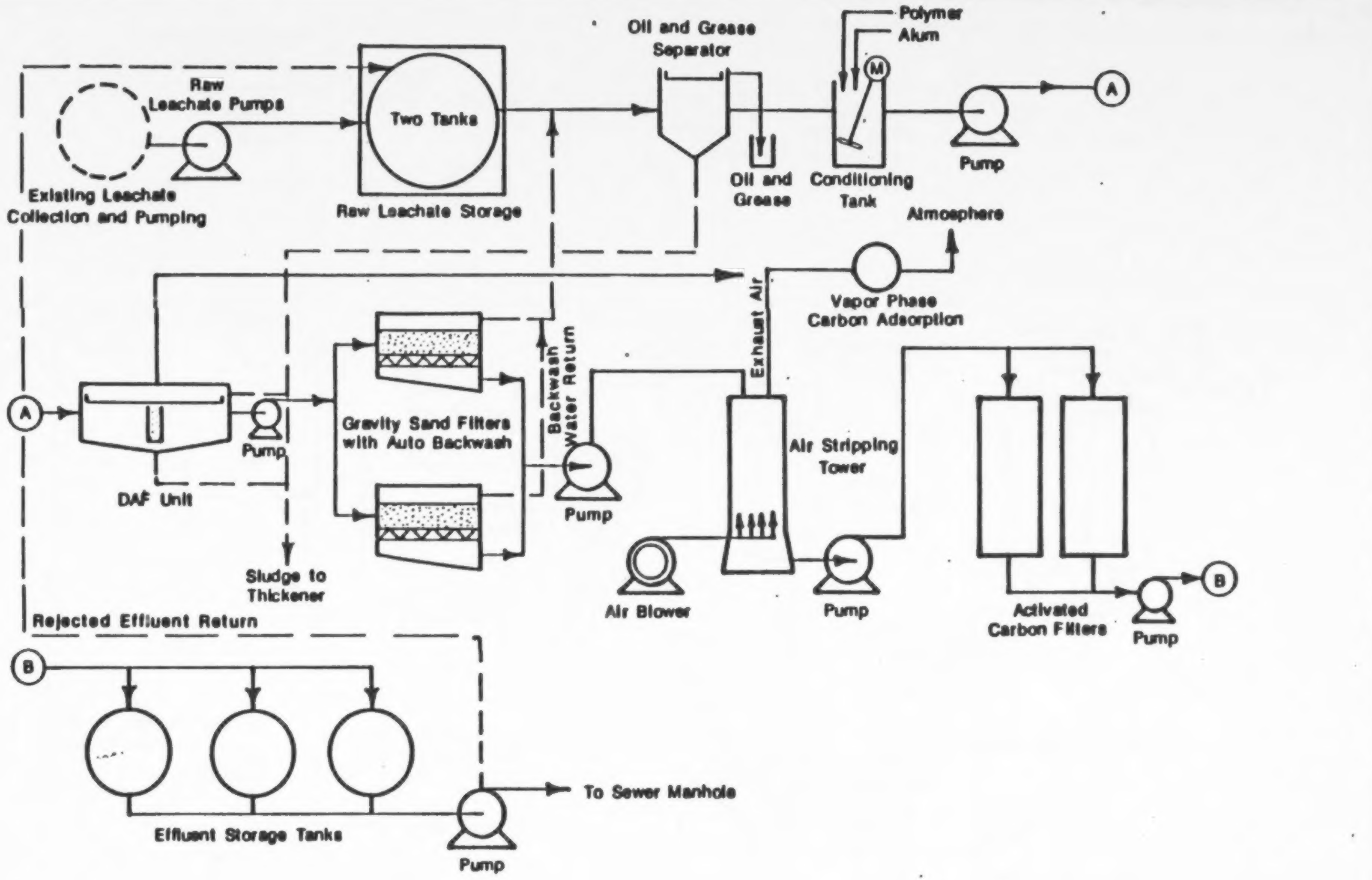
On-site treatment Alternative 3, as depicted schematically in Figure 4-3, employs granular activated carbon (GAC) adsorption following the initial treatment process. Activitated carbon removes organic contaminants from water by the process of adsorption. Activated carbon may not effectively remove the smaller, polar organic constituents in the leachate, such as methylene chloride and vinyl chloride, due to the existence of a complex organic matrix in the waste and the resulting competitive adsorption effects. Alternative 3 should provide organic removal as required to meet the LACSD total toxic organic effluent discharge limitation of 1.0 mg/L. This is essentially the same process train utilized at the ChemTech treatment facility during the period April 1985 through December 1986.

On-site treatment Alternative 5, shown in Figure 4-4, includes both air stripping and GAC adsorption. By utilizing both units, this alternative is expected to achieve the LACSD discharge requirements for both vinyl chloride and total toxic organics. Air stripping will lessen the organic load on the GAC unit thereby reducing carbon consumption and the associated costs. This sytem includes a vapor phase carbon adsorption column to capture toxic constituents present in off-gases from the air stripping tower.

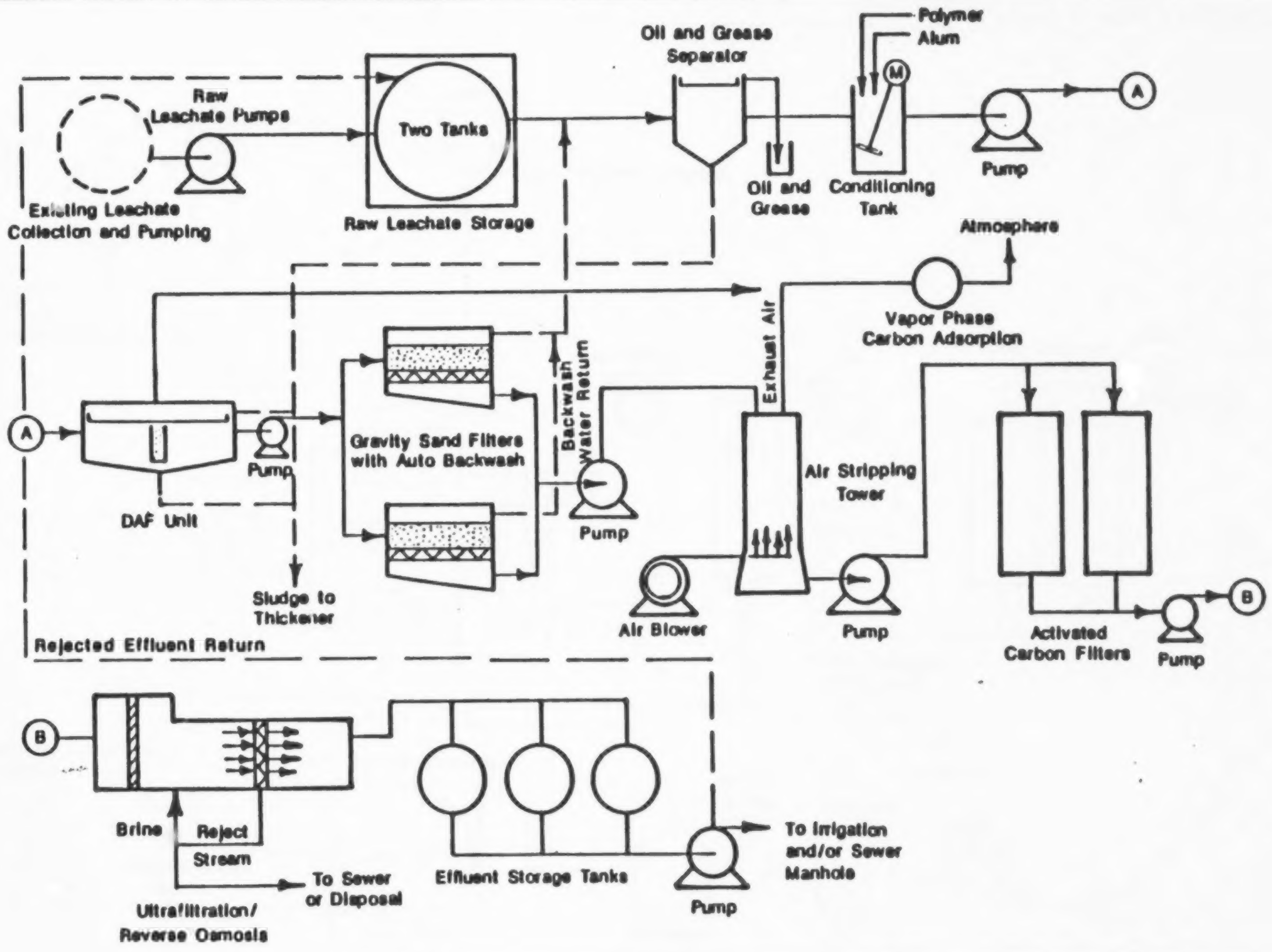
On-site treatment Alternative 6, shown schematically in Figure 4-5, adds ultrafiltration and reverse osmosis to the process train of on-site treatment Alternative 5. This process would remove total dissolved solids from one portion of the treated leachate and concentrate it in another portion, creating two products: irrigation quality water for use on-site and a brine waste high in TDS requiring disposal in the LACSD sewer system. The level of leachate treatment provided by this process train would exceed ARARs for discharge to the POTW.


Existing Leachate Collection and Pumping
Raw Leachate Pumps
Two Tanks
Raw Leachate Storage
Oil and Grease Separator
Oil and Grease
Polymer
Alum
M
Conditioning Tank
Pump
A
Atmosphere or Flare Station
A
DAF Unit
Pump
Sludge to Thickener
Gravity Sand Filters with Auto Backwash
Backwash Water Return
Pump
Activated Carbon Filters
Pump
B
Rejected Effluent Return
B
Effluent Storage Tanks
Pump
To Sewer Manhole

Project No.	Oil Industries Landfill	ALTERNATIVE 3 TREATMENT PLANT PROCESS TRAIN	Figure
120-RI2	Camp Dresser McKee Inc.		1-3


Raw Leachate Pumps
Existing Leachate Collection and Pumping
Two Tanks
Raw Leachate Storage
Oil and Grease Separator
Oil and Grease
Polymer
Alum
M
Conditioning Tank
Pump
A
Atmosphere
Vapor Phase Carbon Adsorption
Exhaust Air
A
DAF Unit
Pump
Gravity Sand Filters with Auto Backwash
Backwash Water Return
Pump
Air Stripping Tower
Air Blower
Pump
Activated Carbon Filters
Pump
B
Sludge to Thickener
Rejected Effluent Return
B
Effluent Storage Tanks
Pump
To Sewer Manhole

Project No.	Oil Industries Landfill	ALTERNATIVE 5 TREATMENT PLANT PROCESS TRAIN PRELIMINARY	Figure
120-RI2	Camp Dresser & McKee Inc.		4-4

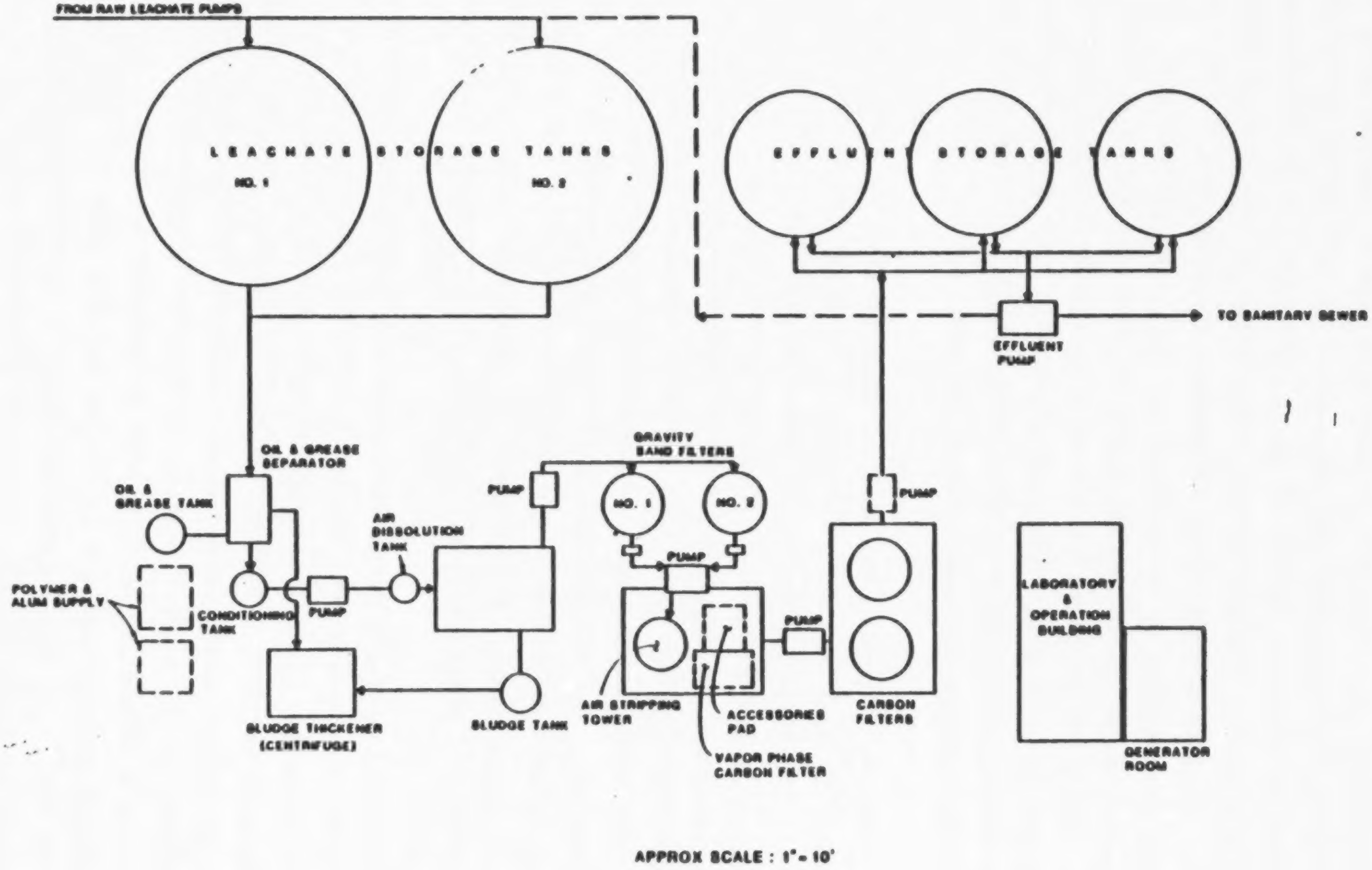

Raw
Leachate Pumps
Existing Leachate
Collection and Pumping
Two Tanks
Raw Leachate Storage
Oil and Grease
Separator
Oil and
Grease
Polymer
Alum
M
Conditioning
Tank
Pump
A
Atmosphere
Vapor Phase
Carbon Adsorption
Exhaust Air
A
DAF Unit
Pump
Gravity Sand Filters
with Auto Backwash
Backwash
Water Return
Pump
Sludge to
Thickener
Air Stripping
Tower
Air Blower
Pump
Activated
Carbon Filters
Pump
B
Rejected Effluent Return
B
Brine
Reject
Stream
To Sewer
or Disposal
Ultrafiltration/
Reverse Osmosis
Effluent Storage Tanks
Pump
To Irrigation
and/or Sewer
Manhole

Project No.	Oil Industries Landfill	ALTERNATIVE 6 TREATMENT	Figure
120-RI2	Camp Dres & McKee Inc.	PLANT PROCESS TRAIN	4-5

The leachate treatment facilities discussed in subsequent sections were sized to treat the liquids collected at a rate of approximately 10,000 gallons/day (justification for this value was presented in Section 1.3.3). In order to minimize impacts of plant operation, it is planned to operate the plant Monday through Friday, eight hours per day during the daylight hours. If flow significantly increases, the plant would have the flexibility of operating up to 24 hours per day. The planned forty hour week operation necessitates process units capable of treating a flow rate of 30 gpm. The plant would be capable of efficiently treating leachate in a flow range of 15 to 35 gpm. Thus, the plant will have the flexibility of handling variations in the rate of leachate collection from 5,100 gallons/ day to 12,000 gallons/day over a seven day week.

For planning purposes, and to be consistent with the final site remedy, flexibility will be incorporated into the plant layout and space requirements. The flexibility will accommodate plant expansion to a 60, to a 90, and/or to a 120 gpm plant. A 120 gpm plant would be required in the event that treatment is required for an average collection rate of 40,000 gallons/day and the forty hour per week schedule is followed. If the plan requires emergency capacity, operation for greater than forty hours would be feasible. An eighty hour, five day operating week at 120 gpm would allow treatment of 115,200 gallons/day. Figure 4-6 shows a possible layout for a 30 gpm plant. A discussion of space requirements for the treatment facility and possible facility expansion is presented in Appendix G.

The operation of the plant will require both influent (leachate) and effluent (treated water) storage. Influent storage of 100,000 gallons (approximately 10 days of leachate collection) is configured into the treatment facility. Effluent storage of 129,000 gallons (three tanks @ 43,000 gallons each) is provided. Influent storage capacity will be utilized in the event the plant is down for a short period of time, and to provide a controlled uniform feed of leachate to the unit process. Effluent storage capacity is needed to allow time for testing effluent since each tank must be analyzed prior to discharge. Ample storage may also be necessary during sewer line maintenance, etc.


FROM RAW LEACHATE PUMPS
LEACHATE STORAGE TANKS
NO. 1
NO. 2
EFFLUENT STORAGE TANKS
TO SANITARY SEWER
EFFLUENT PUMP
OIL & GREASE SEPARATOR
OIL & GREASE TANK
POLYMER & ALUM SUPPLY
CONDITIONING TANK
PUMP
AIR DISSOLUTION TANK
SLUDGE THICKENER (CENTRIFUGE)
SLUDGE TANK
PUMP
GRAVITY SAND FILTERS
NO. 1
NO. 2
PUMP
AIR STRIPPING TOWER
ACCESSORIES PAD
VAPOR PHASE CARBON FILTER
PUMP
PUMP
CARBON FILTERS
LABORATORY & OPERATION BUILDING
GENERATOR ROOM

APPROX SCALE : 1" = 10'

Project No.
120-RI2

Oil Industries Landfill
Camp Dress & McKee Inc.

30 gpm ON-SITE
TREATMENT PLANT LAYOUT
ALTERNATIVE 5

Figure
4-6

As discussed previously, the quality characteristics of the OII leachate, as analyzed to date, are highly variable. It is anticipated that this variability will be experienced in the future leachate collected at the site. As such, the on-site treatment processes must be able to treat a leachate having a wide range in concentrations of oil and grease, heavy metals, organics, and sulfides.

Description of the processes evaluated and their functions are given in the following sections:

Removal of Oil and Grease and Heavy Metals

All of the four on-site treatment alternatives evaluated include a consistent set of unit processes for the removal of oil and grease and heavy metals. This system consists of a gravity corrugated plate separator followed by alum addition in a rapid mix unit, dissolved air flotation and filtration. This process is described below.

Corrugated Plate Separator

Separation is provided as a physical method to provide for phase separation and removal of nonemulsified oils present in the OII leachate. As shown in Appendix C, the oil and grease concentration in the leachate has varied widely, ranging from 6 mg/l to 296,000 mg/l. Most of the samples taken indicated that total oil and grease levels were in the range of several hundred milligrams per liter. Although the degree of emulsification of the total oil and grease in the leachate is unknown, the gravity separator is provided as a method of easily removing the nonemulsified fraction. The separator will be designed to provide a minimum retention time of approximately 40 minutes to allow ample time for adequate quiescent phase separation. The separation process will achieve removal requirement, for leachate having a nonemulsified oil and grease content not exceeding the 3,000 mg/l level. In the unanticipated event of concentration of oil and grease exceeding 3,000 mg/l, the leachate could be retreated, and, if necessary, additional separation capacity could be added.

Two side streams, the grease and oil skimmed from the surface of the separator and settled sludge solids, will be produced by this unit. Skimmed grease and oil will be removed to a storage tank and settled material will be pumped to a sludge holding tank for dewatering and disposal. If the skimmed oil and grease is not hazardous, it will be picked up by a waste oil company. If the skimmings are determined to be hazardous, they will be disposed of at a RCRA landfill.

Rapid Mix Unit

Due to the pumping of the leachate to the treatment plant and surfactants present in the leachate, it is anticipated that a significant fraction of the oil and grease will be in an emulsified form. This will necessitate physical or chemical treatment before effective removal can be achieved. Additionally, a chemical treatment to provide a removal mechanism for heavy metals will be required. A rapid mix unit will be employed to chemically treat the leachate prior to removal of emulsified oil and grease and heavy metals.

Preliminary results of the jar testing on OII leachate (Appendix E), indicated that aluminum sulfate (alum), at a dose of 50 mg/l, was effective in breaking the emulsion as well as providing beneficial coagulation of heavy metals present in the leachate. Further bench-scale testing will be required in order to identify types and proper doses of chemicals for the most efficient performance.

Dissolved Air Flotation

Dissolved air flotation (DAF) is employed for phase separation of the coagulated material, as well as removal of flocculated oil and grease. The DAF unit consists of an air dissolution tank, a flotation tank and related appurtenances including an air compressor system and recirculation pump. Air is dissolved into leachate in the dissolution tank. The flow then passes into the flotation tank where the dissolved air is released in bubble form. Floc particles are driven to the surface by the rising bubbles. Two side streams are produced by DAF units including skimmings and sludges which will be pumped to the sludge holding tank. Additionally, off-gas would emanate from the DAF unit. Emissions from the unit would be passed through a vapor phase carbon adsorption unit.

As shown in Appendix C, only one sample of OII leachate was analyzed for surfactants. This showed a concentration of 4.5 mg/l. At this level, excessive foaming in the DAF unit would not develop. However, one sample is not conclusive and further testing and evaluation will be required in the predesign studies.

Gravity Sand Filters

Gravity sand filtration is provided to capture floc and other suspended solids which are not removed by the DAF unit. This unit is utilized to minimize solids build-up in downstream units and thus to maintain the efficient operation of those units. The proposed filtration scheme consists of passing clarified DAF effluent through a sand filter containing approximately two feet of 0.9 to 1.2 mm size sand. Application rate is projected to be 3 gpm/ft^2 and two filters will be provided to allow for the required backwashing operation. It is estimated that the filters would be backwashed each day at the end of the daily operation. Water would be pulled from the effluent storage tanks. The contaminated backwash water will be pumped to the leachate storage tanks.

The aforementioned set of unit processes are incorporated into all on-site treatment alternatives. They would be designed to provide a reliable and flexible system for removing oil and grease, heavy metals and solid materials. The system would be operated to assure compliance with LACSD pretreatment requirements for oil and grease and heavy metals and would also provide a degree of pretreatment for the organic removal unit processes. Further treatability studies need to be conducted during the pre-design phase to assure the proper types and dosing of coagulants.

Removal of Volatile Organics

Air stripping is used in on-site Alternatives 2, 5 and 6 to remove organic compounds. In liquid waste treatment, air stripping is a unit process in which liquid and air are brought into contact with each other to remove volatile substances from the liquid. If the liquid contains volatile compounds in excess of the equilibrium level, the contaminant will transfer from the liquid phase to the gas phase until equilibrium is achieved. If the air is continuously replaced with fresh non-contaminated air, and if sufficient contact time is allowed, volatile organic compounds will be removed from solution. Semi-volatile organic compounds are not as easily removed by air stripping.

The effectiveness of the air stripping process in removing volatile organic compounds (VOCs) from water is governed by Henry's Law, which states that the concentration of a gas which is dissolved in liquid is directly proportional to the partial pressure of the vapor phase of that gas with which the solution is in contact. As a result, compounds which have high Henry's constants are generally removed more efficiently by the air stripping process. Several volatile organic compounds currently found in the OII leachate, such as vinyl chloride, have high Henry's Law constants and thus would be readily removed. However, the presence of a complex matrix of toxic organic substances in the leachate including several relatively less volatile pollutants, such as phenols and phthalate esters, would not assure that an air stripping system alone would regularly meet LACSD standards for total toxic organics. In order to effectively remove the less volatile organic compounds, the stripping tower air to liquid ratio must be increased significantly and the loading rate decreased, or other unit processes, such as carbon adsorption, must be employed. Stripping tower design data for a 30 gpm plant is presented in Table 4-1. The most commonly used, efficient and economical air stripping system consists of a packed tower with a blower at the bottom of the tower. This system is a proven technology and can achieve high removal efficiencies of volatile organic compounds (VOCs). The overall height of the stripping tower is estimated to be approximately 23 feet which would not be significantly taller than proposed leachate storage tanks. The tower could be partially set below grade or designed with a horizontal flow component to reduce its height and its aesthetic impact.

Air emissions from a packed tower air stripping unit will contain low levels of the contaminants which have been removed from the liquid. For this reason, a system to remove compounds from the stripping tower exhaust will be employed. A vapor phase carbon adsorption unit will be utilized to eliminate ordors and to achieve the desired off-gas treatment. The sizing of the unit will be done as a part of the pre-design study.

TABLE 4-1

AIR STRIPPING DESIGN FOR 30 GPM PLANT

Volatile Organics	
Number of Units	1
Air to Water Ratio	40:1
Water Flow (gpm)	30
Loading Rate gpm/ft2	10
Column Diameter (ft)	2
Packing Depth (ft)	17
Air Flow (per unit) SCFM	160
Electric Power (blowers) HP	1.0

Removal of Organics

Activated carbon removes organic contaminants from water by the process of adsorption (the attraction and accumulation of one substance on the surface of another). In general, high surface area and pore structure of the carbon are the prime factors in adsorption of organics from liquids, whereas the chemical nature of the carbon surface is of relatively minor significance. Generally, activated carbon has been found to remove volatile organic compounds from liquids with removal efficiencies ranging from 40 to 99 percent, depending upon the contaminant characteristics and physical properties of the carbon. Activated carbon has been widely used in water treatment systems for many years for the removal of taste and odors, as well as specific soluble organic materials.

Several factors can influence the effectiveness of an activated carbon adsorption system, including:

a. The nature of the carbon itself;

b. The nature of the material to be adsorbed, including its molecular size and polarity;

c. The nature of the solution, including its pH, temperature, and influent contaminant concentration; and

d. The contacting system and its mode of operation, including contact time between liquid and carbon, influent flow distribution and hydraulic loading rates.

Granular activated carbons are those that are larger than U.S. Sieve Series No. 50. GAC systems generally consist of vessels in which the carbon is placed, forming a "filter bed", which may operate by gravity or under pressure. Once the carbon adsorptive capacity has been fully utilized, the carbon is disposed of or regenerated. Pick-up of spent carbon and off-site regeneration is a service frequently offered by suppliers of activated carbon and would be used for this project. Columns can be operated in series or parallel modes. Vessels are equipped with carbon removing and loading mechanisms to allow for the removal of spent carbon and the addition of new or regenerated carbon. Flow can be either upward or downward through the carbon bed.

The effectiveness of carbon adsorption will depend on the type and concentration of the contaminants present in the leachate. Activated carbon may not effectively remove the smaller, polar organic constituents in the leachate, such as methylene chloride and vinyl chloride, due to the existence of a complex organic matrix in the waste and the resulting competitive adsorption effects. The make-up of the OII leachate is such that GAC units without air stripping columns upstream should provide organic removal required to achieve the total toxic organic effluent discharge limitation of 1.0 mg/l imposed by LACSD. Less efficient use of the carbon would occur if air stripping were not used prior to GAC adsorption thus carbon usage would be greater. Estimates of carbon usage with and without air stripping are presented in Section 4.3. In addition, effective removal of vinyl chloride and methylene chloride will likely require air stripping in conjunction with the GAC unit. This is due to the small size and polar nature of these organic leachate constituents.

The activated carbon columns were preliminarily sized based upon a loading rate of 15 gpm/ft^2 and contact time of 15 minutes. Further treatability studies will be conducted during the design phase to assure proper sizing and loading of the GAC filter units.

Ultrafiltration/Reverse Osmosis

On-site treatment Alternative 6 consists of the Alternative 5 configuration with addition of ultrafiltration and reverse osmosis unit processes. This addition would allow for the production of effluent of irrigation reuse quality, and thus would exceed LACSD standards. The three other on-site treatment alternatives would not reduce the total dissolved solids (TDS) levels of the OII leachate from the influent level of 11,000-12,000 mg/l to a level suitable for irrigation reuse.

Reverse osmosis (RO) is a proven technology for reducing total dissolved solids (TDS) levels in liquid wastes. The process involves the application of sufficient pressure to a concentrated solution to overcome osmotic pressure and force the flow of liquid through a semipermeable membrane to the more dilute phase. This process results in the production of a permeate stream of relatively pure water and a reject stream of increased TDS levels. The reject stream must be bled off and disposed of as waste brine. The waste brine would be discharged to the LACSD sewerage system, provided it met the effluent discharge requirements. The RO permeate would be acceptable for irrigation reuse at the landfill site.

Common RO membranes utilized for TDS removal are constructed of polyamide polymers or cellulose triacetate and are available in various configurations. Membrane life is expected to be three years under normal operating conditions. Actual membrane choice, configuration, and other design criteria would be determined for Alternative 5 during a pre-design study, if this alternative were chosen.

Potential disadvantages to this system include the probable need for extensive pretreatment of carbon-treated leachate prior to introduction into the RO system. RO membranes are subject to chemical attack, plugging and fouling. Leachate effluent from the activated carbon treatment would probably require additional filtering in order to remove small particulates and prevent plugging and minimize colloidal and biological fouling. Ultrafiltration (UF) through 0.45 micron pore size filters is provided in this alternative as a method of additional pretreatment.

Additional pretreatment prior to the reverse osmosis process may also be required to prevent metal oxide fouling and scaling of membranes. Detailed pretreatment requirements would be determined during the pre-design phase. Pretreatment to reduce the metal oxide fouling or scaling of membranes could consist of ion exchange softening or the addition of sequestering agents, if necessary. Generally, pretreatment would be required if the frequency of removing foulants by periodic membrane cleaning is unacceptable from an economic or operations standpoint or if the foulants cause irreversible damage to the membrane. For the purposes of this FS, under the proposed treatment plant operational mode of eight hours per day with adequate manpower supplied, it is assumed that membrane fouling could be controlled by a regular maintenance program conducted by treatment facility operators. It is also assumed that minimal damage to the membranes other than normal compaction would occur. Regular maintenance on the membranes would involve cleaning with an acidic solution and could be performed as required after the normal eight hour operational day.

Another potential limitation to using a RO system to desalinate treated leachate is the limited permeate recovery rate which could be achieved.

Permeate recovery from a reverse osmosis unit is dictated by the desired product water quality (limited by solvent and solute flux) and the precipitation of salts on the membrane which could occur if salt solubility limits were exceeded. The liquid (solvent) flux is dependent upon, the characteristics of the membrane as well as the system and osmotic pressure differential between feedwater and permeate. Salt (solute) flux is dependent upon the salt concentration gradient across the membrane and a salt permeability constant. OII leachate contains TDS (salt) levels of approximately 11,500 mg/l which translates to an osmotic pressure of approximately 120 psi. Based on data for similar RO applications, it is likely that a maximum permeate recovery rate of 40% could be achieved in a one stage RO system. Thus if 10,000 gallons per day of leachate were treated by the RO system, it is estimated that approximately 4,000 gallons of permeate would be recovered and 6,000 gallons of brine would be produced.

Under on-site Alternative 6, permeate recovered from the RO system would be used for site irrigation and brine would be disposed of in the LACSD sanitary sewerage system. California Regional Water Quality Control Bond Basin 4B surface water quality objectives mandate a 750 mg/l maximum level of TDS for reuse applications. The proposed RO system would have to effectively reject approximately 93% of the feed TDS to meet this limit. Typical RO systems when properly designed and operated can achieve this degree of salt rejection, although further study during the pre-design phase would be necessary to determine if the proposed system for OII leachate would regularly meet this limit.

Reject water from the RO system would be discharged to the LACSD sanitary sewerage system and would be subject to industrial pretreatment requirements. It is expected that the waste brine would regularly meet LACSD effluent discharge limitations. Feedwater to the RO system (GAC effluent) would be subject to a concentration factor of less than two at the maximum anticipated permeate recovery rate of 40%. Thus waste brine would contain less than two times the concentration of RO-rejected constituents (salts) including heavy metals that were present in the feedwater. Since heavy metals have been identified in raw leachate usually at very low concentrations with respect to LACSD discharge limitations and since treatment process units upstream of the RO unit are expected to remove a large fraction of the heavy metals present in the raw leachate, it is expected that the concentrated brine would not exceed LACSD standards for heavy metals and could be discharged. Although TDS levels in the brine would be concentrated to approximately 20,000 mg/l, conversations with LACSD indicate that no specific TDS discharge limitations would exist.

If the reuse of treated leachate on-site as irrigation water is pursued, provisions will be required to strictly control land application to prevent runoff and nuisances. During periods of inclement weather when irrigation is not possible, alternative disposal mechanisms such as sewer discharge or storage of effluent will be implemented. The RO system could be bypassed during extended periods of wet weather. The reuse alternative will require compliance with waste discharge requirements issued by the Regional Water Quality Control Board and approval of reclaimed water use by the California Department of Health Services.

Performance

The on-site treatment plant's performance will be measured by its ability to meet the effluent discharge limitations of the LACSD (ARARs). Unit processes with known and proven treatment effectiveness are configured into the treatment plant process train.

The processes selected for the treatment facility are similar to those used by the ChemTech facility, which were tested and shown to be effective in meeting LACSD standards (WCC, 1985). One identified problem with oil and grease removal has apparently been rectified (LACSD, 1986).

During preparation of the predesign report, the following bench scale or pilot plant studies should be performed to more accurately determine individual equipment sizing:

- Accelerated Carbon Tests (ACT). Samples of leachate should be taken before and after air stripping in order to determine carbon usage for those alternatives that utilize or do not utilize an air stripper. Emissions from air stripping should be analyzed to determine contaminant levels. Bench scale carbon adsorption and air stripping tests should be conducted to determine design data.

- Oil and Grease Removal. Samples of conditioned leachate should be sent to DAF vendors for determination of hydraulic and solids loading and for recommendations on sand filters versus multimedia filters.

- Reverse Osmosis Bench Scale Testing. Samples of coagulated, filtered and GAC treated leachate should be run through a bench-scale RO unit to determine design criteria and permeate and brine characteristics. Further, various pretreatment requirements should be evaluated including ion exchange and chemical treatment. These tests should be preceded by a plugging factor determination.

The four on-site treatment alternatives evaluated are all effective in reducing the mobility, toxicity and volume of hazardous constituents in the leachate and could easily be adapted to deal with the variable leachate characteristics.

Reliability

All of the processes configured in the various units comprising the treatment facilities analyzed for the four alternatives are commonly used in industry. Further, they have been used at other leachate treatment facilities. The proposed on-site treatment facilities can be designed to maximize automation and are expected to have low maintenance requirements.

Implementability

The unit process evaluated for the on-site treatment alternatives are standard and/or pre-packaged units. It is estimated that they could be ordered and installed within a 6 to 9 month period. An additional 6 to 12 months should be allowed for process testing, engineering and off-site permit approvals (if required).

4.2.2 SAFETY AND PUBLIC HEALTH PROTECTION

Although the operation of an on-site treatment facility is not expected to pose a significant threat to the health and safety of the surrounding community, several potential concerns must be addressed. Potential risks and community concerns from the operation of an on-site facility include leachate spills, release of malodorous and/or potentially harmful vapors, excessive noise pollution and adverse aesthetic impact. The degree of risk imposed by an on-site facility will depend largely upon the design of the plant and in part on its siting. Any on-site treatment facility would be designed to minimize any potential risk to the surrounding community. Additionally, no contaminated liquids other than those produced due to OII landfill operation would be treated at the on-site plant.

State-of-the-art safety mechanisms and devices to minimize adverse impact to the surrounding community would be incorporated into any of the four on-site treatment plan designs. The entire process train as well as influent and effluent storage tanks would be surrounded by a containment berm designed to contain any potential liquid spill. If a large spill did occur, it would rapidly be pumped back into an enclosed storage structure. Any volatilization of leachate contaminants under these conditions would not be likely to pose health risks due to inhalation exposure. Additionally, a Spill Prevention, Control and Countermeasure Plan (SPCC) would be developed for the plant during the pre-design phase. Alarms and automatic shut-off valves which would halt flow to the plant would be activated in a spill event.

Treatment process units such as DAF and air stripping which result in air emissions would contain a vapor phase carbon adsorption column to scrub off-gases of toxic chemicals and malodorous constituents. As discussed in more detail in section 4.2.3, "Institutional Requirements," no specific limits for discharge of volatile organic substances to ambient air exist for these types of treatment process units. However, a screening risk analysis for specific compounds which could potentially be discharged from the site to ambient air would be necessary prior to the new source review process required by the South Coast Air Quality Monitoring District (SCAQMD). Although pertinent data are extremely limited, a conservative, preliminary assessment of the potential risks that could be associated with release of volatile organic chemicals from treatment process units at the OII site was prepared. For this assessment, likely worst-case ambient air concentrations due to emissions from a vapor phase carbon adsorption column following an air stripper column were estimated by using EPA's PTPLU screening model. PTPLU is a Gaussian plume dispersion model designed to estimate maximum pollutant concentrations at ground level resulting from a single emission source. PTPLU determines the distance to and magnitude of maximum air concentrations from an emission source for various combinations of meteorological variables which simulate expected and worst-case dispersion conditions. The one-hour pollutant concentrations estimated by the model represent the average concentration at a receptor over a one-hour period. Longer averaging times yield lower receptor concentrations due to the variability in wind direction and resulting plume meander.

Air emissions from the combined air stripper carbon adsorption unit represent the most significant emissions from the treatment facility. Ambient air concentrations were estimated for all volatile organic constituents of OII leachate having health-based inhalation exposure guidelines or cancer potency factors for inhalation exposure listed in EPA's Superfund Public Health Evaluation Manual (EPA 1986a). It should be noted that not all chemicals selected for this conservative screening analysis were selected as indicator chemicals for the no-action alternative endangerment assessment presented in section 3.2.1. Input parameters for the model were based on vendor specifications for the vapor phase carbon adsorption unit and include a 97% removal efficiency, a stack height of 3.05 m, an exit temperature of 299.7°K, an exit velocity of 10.16 m/sec, a stack diameter of 0.19 m, and a volumetric flow of 0.29 m^3/sec. It was assumed that the treatment unit operated 5 days per week, 8 hours per day, and treated leachate at a rate of 30 gallons per minute. It was further assumed that the leachate constituents considered were present in leachate at the mean concentrations listed in Appendix C. The model used is designed to give a series of conservative (worst case) results, and the most conservative set of results obtained were selected for this analysis.

The maximum 1-hour ambient concentrations at ground level, estimated to occur at approximately 21 m from the treatment unit, are shown in Table 4-2. As shown in Table 4-2, these values are several orders of magnitude lower than the 8-hour time weighted average concentrations required for

TABLE 4-2

SCREENING RISK ANALYSIS
INHALATION EXPOSURE TO VOLATILE LEACHATE
CONSTITUENTS RELEASED TO AMBIENT AIR FROM ON-SITE TREATMENT UNITS

	OSHA-TWA (mg/m)	ACGIH TLV (mg/m)	Cancer Potency (mg/kg/day)	Maximum Estimated Ambient Concentration b (mg/m)	Average Chronic Daily Intake (mg/kg/day)	Excess Lifetime Cancer Risk
			Carcinogenic Effects			
Benzene	40	30	2.9x10>12? [A]	1.1x10>15?	5.3x10>17?	2x10>18? [A]
Chloroform	225 (ceiling)	50	8.1x10>12? [B2]	2.3x10>15?	1.1x10>16?	9x10>18?[B2]
1,2-Dichloroethane	200	40	3.5x10>12? [B2]	2.7x10>15?	1.3x10>16?	5x10>18?[B2]
Methylene chloride	1,740	350 (175)	1.43x10>12? [B2]	4.1x10>14?	1.9x10>15?	3x10>17?[B2]
1,1,2,2)Tetrachloro) ethane	35	7	2.0x10>11? [C]	2.7X10>15?	1.3X10>16?	3X10>17? [C]
Tetrachloroethylene	670	335	1.7x10>13? [B2]	1.3x10>15?	6.3x10>17?	1x10>19?[B2]
Trichloroethylene	540	270	4.6x10>13? [B2]	3.2x10>15?	1.5x10>16?	7x10>19? [B2]
Vinyl chloride	2	10	2.5x10>12? [A]	1.9x10>15?	9.0x10>17?	2x10>18? [A]
					>____?	
					Total Risk	8x10>17
			Noncarcinogenic Effects			
Acetone	2,400	1,780	3.0	2.0x10>14?	9.5x10>16?	3x10>16?
Chlorobenzene	350	350	5.7x10>13?	5.0x10>16?	2.4x10>17?	4x10>15?
1,1)Dichloroethane	400	810	1.38x10>13?	9.0x10>16?	4.3x10>17?	3x10>16?
Toluene	750	375	1.5	1.9x10>14?	9.1x10>16?	6x10>16?
1,1,1)Trichloroethane	1,900	1,900	6.3	6.0x10>15?	2.8x10>16?	4x10>17?
Xylene	435	435	4.0x10>11?	1.7x10>14?	8.1x10>16?	2x10>15?
					>___?	
					Hazard Index	7x10>15?

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a?Health)based criteria are listed in EPA's Superfund Public Health Evaluation Manual (EPA 1986a). >

b?Maximum estimated ambient concentrations were obtained by using EPA's PTPLU point source dispersion Gaussian screening model >

c?For this analysis, the cumulative doses received on 5 of 7 days per week and 8 of 24 hours per day were expressed as average daily exposures prorated over a 70)year lifetime.

protection of worker health by the Occupational Safety and Health Administration (OSHA). [Maximum 8-hour estimated ambient concentrations can be approximated by multiplying the 1-hour concentrations shown in Table 4-2 by 0.7 (EPA 1977)]. The estimated maximum vinyl chloride concentration is also less than the California Ambient Air Standard of 10 ppb (20 ug/m^3) for this compound. Potential health risks to individuals living in the vicinity of the OII site from the carbon adsorption unit emissions also were estimated using health based criteria published by the EPA (1986a). Local residents would generally be exposed to air contaminants from the carbon adsorption unit at locations several hundred meters from the site rather than the 21 m distance for which ambient air estimates were calculated. Accordingly, ambient air concentrations would be much lower than the values shown in Table 4-2.

Nevertheless, these values were used to provide a very conservative screening analysis. Chronic daily intakes in mg/kg/day were calculated for each of the chemicals considered. Exposure to adjusted 8-hour maximum concentrations was conservatively assumed to occur over a 70-year lifetime in a 70-kg individual. The cumulative doses received on 5 of 7 days per week and during 8 of 24 hours per day were expressed as average daily exposures prorated over a 70-year lifetime. That is, exposure was calculated for a person living 21 m from the air stripper for their entire 70 year lifetime. As shown in Table 4-2, the total worst case excess lifetime cancer risks associated with the potentially carcinogenic volatile constituents of OII leachate are approximately $8x10^{-7}$, that is, less than one in one million. The chronic daily intakes of noncarcinogenic constituents of OII leachate are several orders of magnitude less than their corresponding health-based criteria suggesting that exposure to these compounds individually or concurrently would not be likely to pose health risks. Note that the maximum air pollutant concentration used in the exposure assessment occurred at a distance of 21 meters from the emission source. However, the nearest residents are located approximately 600m from the source. Under the same meteorological conditions, the pollutant concentration at the nearest residence could actually be an order of magnitude lower than the maximum concentration due only to increased dilution of the plume with distance. Dispersion would further reduce concentrations away from the plume. The results of this conservative screening analysis indicate that air emissions from on-site treatment units would not pose significant health risks in the adjacent communities.

Noise pollution which could result from the operation of pumps and blowers used at the facility would be minimized by enclosing these units in sound-muffling encasements. The noisiest components of the proposed facility would be the blowers which supply air to the DAF unit (on-site treatment Alternatives 2, 3, 5, and 6) and the air stripping tower (Alternatives 2, 4, 5, 6). These blowers, when not enclosed in sound-reducing structures, could produce a noise level of nearly 90 decibels at a distance of three feet. Enclosing the blowers would significantly lower noise levels to less than that of a passing car (60-70 db at three feet). The air stripping noise levels should not exceed that from the DAF blowers. Noise levels in residential neighborhoods would depend upon the distance from the proposed facility. Additionally, architectural and landscape design would be undertaken to minimize noise and aesthetic impacts from the plant.

Sewering of treatment plant effluent is not expected to pose any significant health and safety risks to the community. The treatment processes will substantially remove the toxic constituents. The discharge of effluent from the facility would be tightly regulated by the LACSD and the local sewering agency. Each batch of treated effluent would be tested prior to discharge to assure that all pretreatment standards were met. This practically eliminates the possibility of discharging effluent containing high levels of toxic pollutants as the discharge from a tested batch would be manually controlled. Discharges from an on-site treatment plant would be of better quality than wastes already in the sewer system.

4.2.3 INSTITUTIONAL REQUIREMENTS

On-site treatment alternatives evaluated require effluent disposal to the LACSD sewerage system in all cases. The discharge of treated leachate from the on-site treatment plant would be subject to regulation under the general pretreatment provisions of the Clean Water Act and locally implemented specific pretreatment regulations. The general pretreatment requirements apply to the introduction of any nondomestic wastewater into any POTW and include prohibition on discharge which may interfere with, pass through, contaminate sludge, or upset the facility or which is ignitable, corrosive or excessively high in temperature. General pretreatment provisions also direct local POTWs to adopt and implement local discharge limits for those cases where categorical pretreatment standards have not been promulgated and where more stringent discharge controls than those imposed by categorical standards, are required.

EPA issued a memorandum on April 15, 1986, regarding policy for the discharge of wastewater from CERCLA sites into publicly owned treatment works (POTWs). The general position taken by EPA is that full compliance with all applicable requirements of the Clean Water Act (CWA), the Resource Conservation and Recovery Act (RCRA), and any other relevant or appropriate environmental statutes will be necessary. The memorandum states that if the remedial action alternative considers the discharge of wastewater from a CERCLA site into a POTW, a thorough analysis of the POTW's ability to accept this wastewater should be conducted. In addition, SARA requires compliance with all other ARARs on the state and federal level.

The LACSD is the agency charged with implementing and enforcing pretreatment requirements for the sewerage system serving the area surrounding the OII landfill. Sewering of treated leachate from any of the alternative on-site facilities should have no impact on the receiving Joint Water Pollution Control Plant (JWPCP) in Carson, California and the receiving waters (Pacific Ocean). The JWPCP is currently treating over 360 million gallons per day of average daily wastewater flow. The maximum expected treated OII leachate flows will constitute less than 0.0003 percent (3/10,000) of total flow to the JWPCP. The JWPCP also maintains a relatively good compliance record with respect to their NPDES permit and pretreatment program requirements. LACSD was contacted to identify specific requirements or limitations which would apply to an on-site leachate treatment facility at the OII site. Indications were that an on-site treatment plant would be permitted and monitored for its off-site discharge of heavy metals, sulfides, pH, oil and grease, cyanide and total toxic organics. Specific limitations imposed were presented earlier in

Table 2-2. The leachate treatment facility plans would be reviewed by LACSD engineers and the local sewering agency prior to permit issuance to assure that the proposed treatment system would adequately remove the pollutants of concern and that adequate hydraulic capacity was available. Analytical testing of the treatment plant effluent will be required prior to release of effluent to the sewers, thereby necessitating construction of effluent storage tanks. A chemical laboratory has been included in all of the on-site alternatives. The lab will be used to conduct the required effluent testing and process control.

The local sewering agency (Monterey Park or Montebello) in a joint effort with the LACSD, reviews and approves or rejects all industrial wastewater discharge permits (IWDP) prior to transmittals to LACSD. The city of Monterey Park Sanitary Sewer and Industrial Waste Code requires the approval of City Council for any IWDP proposed to discharge landfill wastes into the city sewer system. Approval was granted to OII in August of 1984 by the City Council to sewer treated leachate to the city sewer system using a treatment process similar to Alternative 3 to be located in the vicinity of site A (see Appendix G) and discharging to the Potrero Grande Sewer. A new approval will be required for use of Monterey Park sewers. It is anticipated that approval would be granted if discharge compliance could be assured and adequate sewer capacity is available.

The discharge points of at least two of the proposed connection locations (Sites A and D) involve local branch sewers in the city of Montebello located in residential areas. Approval for discharge would be required from the city of Montebello and a formal agreement between the cities with regard to discharge rates, points of connection, maintenance costs and compensation for lost sewer capacity, would probably be required.

An IWDP fee of approximately $100 would be assessed by the local sewering agency, if approval for discharge were granted. LACSD would charge a one-time connection fee of approximately $40,000 with a user fee surcharge based on levels of chemical oxygen demand and suspended solids and the peak load factor. It is estimated that the surcharge fee would be in the range of $5,000 to $10,000 annually.

Based upon review of Federal and local requirements for sewer disposal of treated OII leachate and of the characteristics of the POTW into which wastes are proposed to be discharged, disposal to the LACSD sewerage system of treated leachate using any of the four proposed pretreatment alternatives appears to comply with EPA policy as long as discharge requirements are met. The probable frequency of compliance with discharge limitations for each of the four treatment plant alternatives are discussed in the reliability section. On-site treatment alternatives would also be subject to review by the South Coast Air Quality Monitoring District (SCAQMD). Based upon conversations with SCAQMD, it was determined that any new potential pollution emission source would have to undergo a new source review process by SCAQMD. This review would be conducted after a screening risk analysis for the specific compounds which could potentially be discharged from the site. No specific limits for volatile organic substances exist, although a general organic discharge limit of 75 pounds per day does exist. SCAQMD indicated that they have no specific "best available control technology" for off-gas control from air strippers, although the risk analysis should include any control technologies proposed. Additionally, a new toxics rule is currently being developed to limit the discharge of toxics to air and may be promulgated within the next year.

Sludge generated by the proposed on-site treatment facility, if hazardous, would be subject to various regulations. The EPA office of Solid Waste and Emergency Response issued a policy memorandum on October 2, 1985, describing EPA's position regarding on and off-site response actions and compliance with other environmental statutes. This policy states that off-site storage, treatment and disposal facilities must be in compliance with all applicable or relevant and appropriate requirements of Federal environmental and public health laws.

Presently, no facility is available in California for disposal of hazardous sludges. However, it is expected that by the time an on-site treatment plant would be constructed and operating, at least one site would be available in California. Currently, hazardous sludge produced through treatment of CERCLA wastes must be hauled to Chemwaste in Arlington, Oregon or USPCI in Murray, Utah.

4.2.4 ENVIRONMENTAL IMPACTS

On-site treatment alternatives would reduce the volume of leachate present at the OII site and consequently reduce the risk of leachate contamination of environmental media in the vicinity of the OII site and the attendant environmental risks. On-site treatment and sewering of effluent in accordance with LACSD standards results in improved environmental conditions at the site in comparison with the no-action alternative by capturing and concentrating toxic pollutants for ultimate destruction rather than allowing continual release of contaminants to the environment.

Only minimal adverse effects on the environment would be expected due to construction and operation of an on-site treatment facility. Construction activities may cause some adverse effects to the area; however, these would be short-lived and of minimal consequence. Site preparation activities would be performed with an approved erosion and sediment control plan. The treatment plant process units and buildings would be placed on slabs at grade, eliminating the need for extensive excavation. Dust control measures would be employed throughout the period of construction to prevent the migration of dust into nearby communities. No heavy construction equipment would be required during the facility construction that would add significant noise levels. During the daylight hours during which site work would be performed, the ambient noise levels are high due to the heavy flow of traffic on the Pomona Freeway. Site noise should not exceed the ambient noise level in the area and therefore should not present any problems. Odors will not be generated during site work primarily because areas where garbage was disposed of would not be disturbed.

Operation of the treatment facility should not have any adverse effects on the surrounding areas. The facility which only requires the operation of small pumps and a blower is not by nature a noisy operation. Even so, noise abatement features would be incorporated into the design of the plant. Furthermore, the plant is sized so that it would be able to treat the collected leachate by operating eight hours a day, five days a week. Therefore, the plant would operate during the period of highest ambient noise levels and should not affect nearby neighborhoods. Odor control will also be incorporated into the plant design. Units such as the DAF unit that could emit undesirable odors will be closed and gases produced in the process will be vented to either the air stripping vapor phase carbon adsorption unit or to a flare station. Effluent testing prior to batch discharge will assure compliance with LACSD standards. A regular emission testing program will be incorporated into the operation of the facility to assure that air quality is not adversely affected. As noted in section 4.2.2, "Safety and Public Health Protection," emissions are not likely to pose significant health risks, and likewise would not be expected to contribute significantly to deterioration of air quality in general. Additionally, a SPCC plan would be developed to identify response actions that could be undertaken to minimize adverse health and environmental impacts if a spill were to occur. Environmental controls to minimize the effect of spills, such as containment berms, and treatment of storm water and plant wash water will be incorporated into plant design.

4.3 EVALUATION OF ALTERNATIVES BASED ON COST

This section of the report presents the costs of the alternatives discussed in Sections 4.1 Off-Site Treatment and 4.2 On-Site Treatment. These costs were developed from the descriptions and layouts presented in Sections 4.1, 4.2 and in Appendices F and G. Costs were estimated to achieve an accuracy level of -30 to +50 percent for each alternative, as specified in the Remedial Action Costing Procedure Manual (US EPA, 1985). A present worth analysis was performed for the purpose of costing alternatives over a five year and a 30 year operational period. The two periods were selected to identify the cost effective alternatives in both a short-term and long-term response action at the OII site. Present worths of the alternatives were determined using interest rates of 6 and 8 percent (specified by EPA Region IX). In conducting the analysis for the 30-year period it was assumed that the process train components have a 15-year useful life and that replacement is required in year 16. The present worth analyses for the 5-year on-site alternatives is conservative (on the high side) because salvage value of the facility after five years was not considered. Present worth over a 5-year period was calculated to demonstrate cost-effectiveness during the period before the final remedy is implemented. Present worth over a 30-year period illustrates additional cost-effectiveness if long-term treatment is required.

4.3.1 CAPITAL COST ESTIMATES

In the following sections, a cost analysis is presented for those remedial action alternatives remaining after the initial screening. For the purpose of future cost updating, these cost estimates are referenced to the ENR 20 city construction Cost Index Value of 4341.53 (October 16, 1986).

For the purpose of preparing the remedial action alternatives cost estimates, the following assumptions were made:

- Off-site and on-site treatment alternatives
  - The annual leachate collection rate, based on expected leachate (liquid) collection and extraction, is 3,744,000 gallons or approximately 10,000 gallons/day.
- On-site treatment alternatives:
  - A 30 gpm plant with an operating range of 15 to 35 gpm will be constructed.
  - The treatment plant process units will be mounted on individual concrete pads and configured to allow for plant expansion to 60 gpm, to 90 gpm, and/or 120 gpm.
  - Size of the site to accommodate future expansion to a 120 gpm facility must be approximately 60,000 ft^2.
  - A ten foot high block wall will be constructed around the facility and the site will be landscaped.
  - Influent (leachate) storage of 100,000 gallons will be provided.
  - Treatment plant effluent will be batched for testing prior to discharging to the LACSD sewers. Three 43,000-gallon tanks will be provided.

- A laboratory trailer will be set up on site to perform the required testing of treated leachate. A certified chemist will run the lab.
- The point of sewering the effluent will be the manhole closest to the location of the treatment plant.
- The treatment plant and laboratory will be run on a contract basis.
- Appropriate noise and odor abatement features are incorporated into the design of the treatment plant.
- Sludge produced (approximately 1/2% by volume) will be trucked to a Class I disposal facility.
- Oil and grease removed in the separator will be picked up by a waste oil company and will be re-refined.

o The cost for rental of the above ground leachate storage tanks is part of the off-site treatment alternative cost. It is assumed three vapor proof tanks will be maintained on-site.

o The costs for operating the leachate collection system are the same for all the alternatives and are not included in the estimates presented in this FS.

A summary of capital costs are shown in Table 4-3. The details and breakdown of the costs are contained in Appendix F. An evaluation and cost analysis of siting at different "on-site" locations is presented in Appendix G.

Cost estimates are based upon information and quotes as follows:

o Off-site treatment costs at ChemTech are based on their December 2, 1986 bid to the EPA for treating the OII leachate. OPC also provided a bid amount for treating the OII leachate.

o Leachate hauling costs are based upon the actual cost of trucking from the OII site to the ChemTech facility in Vernon, CA and were estimated for hauling to the OPC site in Los Angeles, CA.

o On-site treatment plant and the various process unit costs were obtained by direct quotes from vendors. Costs estimates include the cost of normal field installation and hook-up.

o Costs for site work, access roads and pipelines are CDM in-house estimates for performing general civil work.

TABLE 4-3

SUMMARY OF CAPITAL COSTS

ALTERNATIVE	COST ($)				
		LOCATION (a)			
	OFFSITE	A	B	C	D
OFF-SITE TREATMENT	$30,000				
ON-SITE					
2. Chemical Add., DAF, Air Stripping		$1,690,425	$1,861,530	$1,965,645	$1,728,705
3. Chemical Add., DAF, GAC.		$1,705,305	$1,876,410	$1,980,525	$1,743,585
5. Chemical Add., DAF, GAC, Air Stripping		$1,804,275	$1,975,380	$2,079,495	$1,842,555
6. Chemical Add., DAF, Air Stripping, GAC, UF/RO		$2,126,075	$2,297,180	$2,401,295	$2,164,355

a) It is estimated that the capital costs for a facility sited at location E would fall in the range of the costs for location A and location C.

4.3.2 ANNUAL OPERATION AND MAINTENANCE COST

The following assumptions were made for annual cost estimates for on-site treatment:

- The on-site treatment facility will be operated on a one shift per day basis (8 hours), five days per week.
- The on-site treatment facility, including laboratory operations, would be sub-contracted. The staff would be comprised of:

Staff	Wage Rate/Hour
Supervisor	$ 18
Process Operator	15
Assistant Operator	13
Chemist	20
	$ 66

$66/hr x overhead(2.8) = $184.80/hour x 40 = $7,392/week.

- Plant maintenance and equipment repair costs (electrical, mechanical, etc.) are estimated at $1,000 per month.
- Alternative 1 is based upon the off-site treatment of 3,744,000 gallons per year at a transportation and treatment cost of $0.34/gallon.
- Alternative 4 carbon usage is based upon an estimated COD removal of 45% of an influent level of 4,900 mg/l through gravity separation, chemical addition, DAF and filtration with an additional 20% COD removal through the air stripping tower. Also assumed for this calculation, based on a single isotherm test run in 1984, were a carbon loading of 0.26 mg COD/mg carbon and a maximum adsorbable COD concentration of 75%
- Alternatives 2 and 3 annual costs reflect the removal of and addition of carbon costs, respectively, to Alternative 4. Alternative 5 adds the anticipated power, maintenance and membrane costs for reverse osmosis/ultrafiltration to Alternative 4. Details of the annual cost estimates are included in Appendix F.

Annual costs for the alternatives are summarized in Table 4.4. It is emphasized that the costs are adequate for feasibility study purpose, i.e. - 30% to +50%. The predesign study will better define parameters that will provide the basis for a refined cost estimate.

4.3.3 PRESENT WORTH ANALYSIS

Present worth was calculated for 6 percent and 8 percent discount interest rates for 5-year and 30-year operational periods. Equipment will not have to be replaced during the 5-year operational period.

Present worth was determined by multiplying annual costs by the Present Worth Factor (PWF).

$$PWF = \frac{(1 + i)^n - 1}{i\ (1 + i)^n}$$

where PWF is the present worth factor
i is interest rate as a fraction
n is the number of years in the period

for $n = 5$
$PWF = 4.212$ @ $i = 6\%$
$PWF = 3.993$ @ $i = 8\%$

for $n = 30$
$PWF = 13.765$ @ $i = 6\%$
$PWF = 11.258$ @ $i = 8\%$

The present worth analysis for siting a treatment plant at Location A is summarized in Table 4.5. The present worth for alternative siting of the base treatment facility, Alternative 4, is presented in Appendix G.

SUMMARY OF ANNUAL STS

ALTERNATIVE	COST ($)				
		LOCATION (a)			
	OFFSITE	A	B	C	D
OFF-SITE TREATMENT	$1,609,110				
ON-SITE					
2. Chemical Add., DAF, Air Stripping		$553,000	$558,000	$558,000	$560,500
3. Chemical Add., DAF, GAC.		$775,500	$780,500	$780,500	$783,000
5. Chemical Add., DAF, GAC, Air Stripping		$700,500	$705,500	$705,500	$708,000
6. Chemical Add., DAF, Air Stripping, GAC, UF/RO		$738,000	$743,000	$743,000	$745,500

TABLE 4-5

PRESENT WORTH ANALYSIS
(Figures represent cost in present day dollars)
(Location B) (a)

ALTERNATIVE	DISCOUNT RATE	COST ($) (b)			PRESENT WORTH	
	(%)	CAPITAL (5 YR.)	CAPITAL (30 YR.)	ANNUAL O&M	5 YEARS	30 YEARS
OFF-SITE TREATMENT	6	$30,000	$30,000	$1,609,110	$6,807,571	$22,179,399
	8	$30,000	$30,000	$1,609,110	$6,455,176	$18,145,360
ON-SITE						
2. Chemical Add., DAF, Air Stripping	6	$1,861,530	$2,241,452	$558,000	$4,211,826	$9,922,322
	8	$1,861,530	$2,143,286	$558,000	$4,089,624	$8,425,250
3. Chemical Add., DAF, GAC.	6	$1,876,410	$2,256,332	$780,500	$5,163,876	$12,999,914
	8	$1,876,410	$2,158,166	$780,500	$4,992,946	$10,945,035
5. Chemical Add., DAF, GAC, Air Stripping	6	$1,975,380	$2,355,302	$705,500	$4,946,946	$12,066,509
	8	$1,975,380	$2,257,136	$705,500	$4,792,441	$10,199,655
6. Chemical Add., DAF, Air Stripping, GAC, UF/RO	6	$2,297,180	$2,677,102	$743,000	$5,426,696	$12,904,497
	8	$2,297,180	$2,578,936	$743,000	$5,263,979	$10,943,630

a) Location B is the preferred siting Alternative

b) 30 year Capital Cost includes equipment replacement at the end of year 15.

5.0 SUMMARY OF ALTERNATIVES

This section presents a summary of the detailed alternative evaluation that was conducted in section 4. Evaluations were based upon the following criteria:

- Protection of public health and welfare;
- Environmental impacts;
- Technical (performance, reliability and implementability);
- Institutional constraints (public concerns); and
- Cost-effectiveness

The results of this evaluation will be used by the EPA to identify a preferred alternative that is protective of public health and the environment, that is cost effective, that utilizes permanent solutions, and that will be consistent with the long-term remediation of the OII landfill problems. Consistency with the final remedy is not one of the specified evaluation criteria; however, for a response action that is implemented prior to the final remediation it becomes an important consideration. In general, management of the leachate in a manner that reduces the volume of leachate at the site is consistent with long-term remediation. All of the alternatives that were developed accomplish volume reduction and none of the alternatives would preclude other future remedial actions. Flexibility is maintained in the on-site treatment alternative by:

- Sizing for the short-term leachate/liquid treatment requirements but providing space for future expansion;

- Configuring treatment processes that can function over a broad range of leachate quality characteristics; and

- Configuring a treatment facility that can readily be adapted to treat groundwater, if required, as part of the long-term remediation, or which can be removed if no further treatment is necessary.

All five of the treatment alternatives evaluated in detail in Section 4 are based on simple, proven technologies. Three of the alternatives can attain the applicable or relevant and appropriate requirements (ARARs) as determined in Section 3 and would not be likely to pose significant risks to public health, welfare, or the environment: Off-Site Treatment, and two of the on-site treatment alternatives. Alternative 3 provides for chemical addition to remove heavy metals, and activated carbon to remove toxic organics; Alternative 5 provides for chemical addition to remove heavy metals, air stripping for the removal of volatile organics, and activated carbon for removal of other toxic organics. Alternative 3 and 5 can achieve about the same levels of treatment however Alternative 3 would expend the activated carbon at a much high rate than Alternative 5. Alternative 2 provides for chemical addition to reduce heavy metals, and air stripping to remove volatile organics. Less volatile organics may not be removed to a sufficient degree to meet ARARs. Alternative 6 adds ultra-filtration and reverse osmosis to Alternative 5 in order to produce water of suitable quality for discharge to a POTW or for reuse for irrigation. Alternative 6 would exceed the ARARs for pre-treatment and discharge to a POTW and would not be likely to pose significant risks to public health, welfare, or the environment.

The No Action alternative was addressed in the screening section and was eliminated due to public health, welfare, and environmental considerations.

In addition to the evaluation of treatment process alternatives, alternatives were evaluated for siting the leachate treatment facility at different on-site locations. The analysis, presented in Appendix G, shows that the on-site treatment costs and present worth costs are not significantly affected by site location. Sites B and E involve the transport of leachate across the Pomona Freeway and site location D was determined to be potentially inconsistent with the final remedy. Implementation of any of the proposed on-site alternatives will have a minor, short-term effect on the environment during construction. Dust control would be used during site preparation to keep dust from migrating off-site. Present worth costs at an interest rate of 6% for 5 years range from $4,754,781 at location A to $5,051,061 at Location C.

Present worth costs at an interest rate of 6% for 5 years (operation and maintenance plus capital costs) for the five treatment alternatives considered in detail, range from $4,211,826 (Alternative 2, Site B) to $6,807,571 (Alternative 1).

For the thirty-year period at 6% present worth costs range from $22,179,399 (Off-site treatment) to $9,922,322 (Alternative 2, Site B).

The present worth costs for an interest rate of 6% are summarized in Table 5-1a (facility sited at Location B). Table 5-1b contains the present worth cost for an interest rate of 8%.

TABLE 5-1a

INTERIM LEACHATE TREATMENT ALTERNATIVE SUMMARY FOR THE OII LANDFILL SITE - SITE B

ALTERNATIVE	COST ($1,000)			PUBLIC HEALTH CONCERNS	ENVIRONMENTAL CONCERNS	TECHNICAL CONCERNS	COMMUNITY RESPONSE CONCERNS	INSTITUTIONAL CONCERNS
	CAPITAL 5 YR	PRESENT WORTH @ 6% 5 YR	30 YR					
NO ACTION	---	---	---	Unacceptable exposure to leachate migrating off-site. Potential health risks due to leachate exposure.	Potential for widespread environmental contamination.	---	Unacceptable	Does not meet ARARs.
OFF-SITE TREATMENT	30	6,808	22,179	Potential for human exposure due to spillage of leachate during loading, unloading, transport and treatment. Exposure to air emissions.	Potential for surface and groundwater contamination due to spillage during transport.	Reliability	Acceptable	Meets ARARs if facility operated in compliance. No control over compliance.
ON-SITE TREATMENT								
2) Chemical add., DAF, filtration, air stripping	1,862	4,212	9,922	Potential for spills during treatment, however, spills would be fully contained at the facility.	Minimal effects during construction.	May not remove organics to an acceptable level.	Plant location, aesthetic impact, noise, odors, safety.	May not meet ARARs. May not receive approval for discharge.
3) Chemical add., DAF, filtration, carbon adsorption	1,876	5,164	13,000	Potential for spills during treatment, however, spills would be fully contained at the facility.	Minimal effects during construction.	Less efficient performance without air stripping.	Plant location, aesthetic impact, noise, odors, safety.	Meets ARARs.
5) Chemical add., DAF, filtration, air stripping, carbon adsorption	1,975	4,947	12,067	Potential for spills during treatment, however, spills would be fully contained at the facility.	Minimal effects during construction.	None	Plant location, aesthetic impact, noise, odors, safety.	Meets ARARs.
6) Chemical add., DAF filtration, air stripping, carbon adsorption, U.F., R.O.	2,297	5,427	12,904	Potential for spills during treatment, however, spills would be fully contained at the facility.	Minimal effects during construction.	Possible membrane fouling problems. Low permeate recovery rate. Brine disposal.	Plant location, aesthetic impact, noise, odors, safety.	Exceeds ARARs for sewer disposal. May have difficulty attaining reuse standards.

--- = not [illegible]cable

TABLE 5-16

INTERIM LEACHATE TREATMENT ALTERNATIVE ARY FOR THE OII LANDFILL SITE - SITE B

ALTERNATIVE	COST ($1,000) CAPITAL 5 YR	PRESENT WORTH @ 8% 5 YR	PRESENT WORTH @ 8% 30 YR	PUBLIC HEALTH CONCERNS	ENVIRONMENTAL CONCERNS	TECHNICAL CONCERNS	COMMUNITY RESPONSE CONCERNS	INSTITUTIONAL CONCERNS
NO ACTION	---	---	---	Unacceptable exposure to leachate migrating off-site. Potential health risks due to leachate exposure.	Potential for widespread environmental contamination.	---	Unacceptable	Does not meet ARARs.
OFF-SITE TREATMENT	30	6,455	10,145	Potential for human exposure due to spillage of leachate during loading, unloading, transport and treatment. Exposure to air emissions.	Potential for surface and groundwater contamination due to spillage during transport.	Reliability	Acceptable	Meets ARARs if facility operated in compliance. No control over compliance.
ON-SITE TREATMENT								
2) Chemical add., DAF, filtration, air stripping	1,862	4,090	8,425	Potential for spills during treatment, however, spills would be fully contained at the facility.	Minimal effects during construction.	May not remove organics to an acceptable level.	Plant location, aesthetic impact, noise, odors, safety.	May not meet ARARs. May not receive approval for discharge.
3) Chemical add., DAF, filtration, carbon adsorption	1,876	4,993	10,945	Potential for spills during treatment, however, spills would be fully contained at the facility.	Minimal effects during construction.	Less efficient performance without air stripping.	Plant location, aesthetic impact, noise, odors, safety.	Meets ARARs.
5) Chemical add., DAF, filtration, air stripping, carbon adsorption	1,975	4,792	10,200	Potential for spills during treatment, however, spills would be fully contained at the facility.	Minimal effects during construction.	None	Plant location, aesthetic impact, noise, odors, safety.	Meets ARARs.
6) Chemical add., DAF filtration, air stripping, carbon adsorption, U.F., R.O.	2,297	5,264	10,944	Potential for spills during treatment, however, spills would be fully contained at the facility.	Minimal effects during construction.	Possible membrane fouling problems. Low permeate recovery rate. Brine disposal.	Plant location, aesthetic impact, noise, odors, safety.	Exceeds ARARs for sewer disposal. May have difficulty attaining reuse standards.

--- = not applicable

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APPENDIX A

ORGANIZATIONS AND INDIVIDUALS CONTACTED

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ORGANIZATIONS AND INDIVIDUALS CONTACTED
(Outside of EPA Staff and REM II Project Team)

1. Lockman & Associates, Monterey Park, CA
   - Mr. Terry Boston
   - Mr. John Sepich
2. City of Monterey Park, CA
   - Mr. Henry Terashita
3. California Department of Health Services (DOHS), Los Angeles, CA
   - Mr. Harry Sneh
4. Los Angeles County Sanitation District (LACSD), Whittier, CA
   - Mr. Mark Miller
5. Ecology & Environment
   - Mr. Geoff Knight
   - Mr. Eric Ruston
   - Ms. Patty Cook
6. California Regional Water Quality Control Board (RWQCB), Los Angeles, CA
   - Mr. Ray Delacourt
7. South Coast Air Quality Management District (AQMD), El Monte, CA
   - Mr. Steve Levy
   - Mr. Fred Lettice
8. ChemTech Systems, Inc., Vernon, CA
   - Mr. Ron Stock
9. Oil Process Company, Los Angeles, CA
   - Mr. Al Thompson
10. Chemical Waste Management Inc., Coalinga, CA
    - Mr. Fred Miller
    - Mr. Mark Lenkowski
11. CH2M Hill, Irvine, CA
    - Mr. Ed Rogan
12. City of Montebello
    - Mr. Clark Siegmeyer

APPENDIX B

HISTORICAL BACKGROUND OF OPERATING INDUSTRIES, INC.

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HISTORICAL BACKGROUND OF OPERATING INDUSTRIES INC.

Dec., 1946	Monterey Park City Council granted a five-year contract to Monterey Park Disposal Company (MPD) for trash collection; effective January 1, 1947. Contract stated that MPD could dispose of garbage at selected sites in Monterey Park as designated by City Council. Hilldale Tract on South Garfield and areas of Old Garvey Ranch used as MPD dumpsites were closed due to court action or inadequate fill capacity.
Oct., 1948	Lease of Los Angeles County area in SE corner of Monterey Park is negotiated by MPD from a Mr. Henry Wheeler, effective December, 1948. Dump operations were begun on this portion of the Wheeler property but the operation also extended into County property, and MPD applied for but was denied a County special use permit.
Feb., 1949	Monterey Park annexed Wheeler property being used for dump operation that was located in the County. This annexation was approved on January 17, 1949, by the City Council and became official on February 16, 1949.
Mar., 1949	For a period from April 1, 1949, to November 30, 1949, the entire Wheeler property was subleased to the City of Monterey Park. Operation agreement provided that MPD would operate a City municipal dump in which the City would receive the first one thousand dollars of gross monthly receipts and five percent of other earnings.
Jan., 1952	A new agreement provided for the operation of a commercial cut and cover dump to be run by MPD and cancelled the 1949 sublease. This gave the City free dumping privileges of municipal trash and granted the City the right to impose reasonable operation standards. MPD must acquire zone variance and permit by July 1, 1952, for agreement to be valid. This agreement was on a condition that Montebello would annex a portion of the site, which they did not do. Therefore, the landfill reverted to private ownership (OII).
Feb., 1952	City Council granted permit to operate dump.
Feb., 1953	Wheeler Annexation #2 was approved.
Oct., 1955	Inspection of OII site was made by David MacArthur, and it was found that there were large areas of uncovered trash, piles of oil cans, and a 300′ by 100′ pool of oil.

June, 1956	Special Use Permit 25-26 was issued for possible annexation of 80 additional acres on Wheeler property (Wheeler Annexation #3). Permit stated that fill would not be dumped on Greenwood Avenue right-of-way.
June, 1957	Zone exception 2977-1 was granted by the L.A. County Zoning Board.
Oct., 1957	Ban on use of residential incinerators was issued by County.
Nov., 1957	Planning Commission adopts Resolution 60-57 which granted dump operation variance upon Council vacating that portion of Greenwood Avenue outlined in Resolution 25-26.
Feb., 1958	Council adopted new Municipal Code standards for commercial dump operation.
Oct., 1958	Resolution 60-58 was adopted by Planning Commission, granted a variance to authorized dumping operations including proposed annexed areas. Terminate Resolutions 25-56 and 60-57. Council also adopted Resolution 6206 which initiated proceedings for Wheeler Annexation #3. 60-58 also sets disposal limits (types and amounts), including a 10 gallon per cubic yard limit on liquid waste over the entire landfill.
Dec., 1958	Montebello Planning Commission requested that Monterey Park confirm the proposed Greenwood Avenue route, set a 490-foot limit (height) on landfill, and initially fill the area next to the single-family housing development in Montebello.
Jan., 1959	Monterey Park City Engineer confirmed Greenwood Avenue route and 490 foot height limit, but stated that filling the area next to the Montebello residential development would be incompatible with dump operations.
	Council adopted Wheeler Annexation #3 Agreement.
Aug., 1974	NRG NUFUEL entered into relationship with OII to test and evaluate the landfill for gas extraction operations.
Mar., 1975	Montebello deleted Greenwood Avenue from General Plan.
Apr., 1975	Monterey Park City Manager to schedule meeting with Montebello to propose a landfill study to consider possible uses of the site.
June, 1975	Use permit modified by Planning commission that allowed a dump height of 605 feet, and allowed only clean dirt dumped on the North 45 acres and the east 15 acres.

Aug., 1975	Limit on dump height increased to 640' by the City Council. This plan was subject to a slope stability analysis, grading and landscaping plans, an on-demand Greenwood right-of-way dedication, complete storm drainage system, dumping volume figures given to City for future disposal of unusable landfill during the Greenwood Avenue construction, installation of a gas monitoring system, and all of the Resolution 60-58 conditions.
Nov., 1975	Council approved landscape plan for fill.
Feb., 1976	Council set final landfill elevations, based on the slope stability investigation by Converse, Davis and Dixon Associates, at a maximum of 650 feet with an average height of 629 feet.
Mar., 1976	CRWQCB adopted Order #76-30 which allowed 10 gallons of liquid waste to be disposed of per cubic yard of refuse on the western half of OII's Class II disposal site.
May, 1976	City agreed to the purchase of irrigation water from Montebello by OII.
Sep., 1976	Los Angeles Regional Water Quality Control Board, (CRWQCB), Order #76-133, limits liquid hazardous waste disposal (20 g/yd^3 on 32 of the 130 acre south parcel). .
1978	SCAQMD issued Order of Abatement #2121 specifying that the landfill must comply with such items as minimum cover, grading, liquid deposition, dust control, excavation, and monitoring requirements.
Jan., 1978	Intense odor problems noted, resulting in enforcement agencies inspecting the facility. They found violations for solid waste hauling and disposal, slopes and cuts, intermediate and final cover, gas and erosion control, grading of fill surfaces, excessive odors and ponding of liquids. Corrective actions were ordered.
May, 1978	DOHS received Application for Operating Permit from OII for Facilities Receiving Hazardous Waste.
Dec., 1978	State Solid Waste Management Board granted OII a permit for solid waste disposal.
Aug., 1979	Getty Gas Extraction System was installed.
Fall, 1980	Leachate collection system construction begins.
Oct., 1980	DOHS received another Application for Operating Permit for Facilities Receiving Hazardous Waste.
	California Solid Waste Management Board adopted resolution which placed OII on the Federal Open Dump List.

Nov., 1980	U.S. EPA, Region IX, received RCRA Part A application from OII.
Jan., 1981	Los Angeles County DOHS issued a cease-and-desist order under Permit #19AM001. Order was in response to OII's operation of a landfill without a control plan for potentially hazardous gases and lack of a gas migration control system.
June, 1981	Phase I Air Dike System installed.
Dec., 1981	DOHS issued OII an Interim Status Document #CAT080012024, which authorized continued land disposal operations subject to the conditions of the document.
1982	Landfill leachate bleeds began in Iguala Park residential areas.
Aug., 1982	State DOHS and EPA conduct separate RCRA Interim Status compliance inspections. Found that facility is lacking an adequate groundwater monitoring program and a formal waste analysis plan.
Dec., 1982	DOHS inspected OII and found apparent violations of ten (10) Interim Status Documentation (ISD) provisions.
Jan., 1983	DOHS sent enforcement letter to OII regarding the ten (10) Interim Status Documents (ISD) violations.
	OII stopped Class I waste disposal.
	EPA requested OII's RCRA Part B application which was due August 1, 1983.
Feb., 1983	OII notifies EPA that no Part B was necessary since OII had ceased all hazardous wastes disposal.
	Construction of Phases II/III/IV gas migration control systems begin at OII.
Mar., 1983	Mudslides occurred on the northern face of the south parcel near the Greenwood Ave. overpass due to heavy rainfall.
Apr., 1983	South Coast Air Quality Management District (SCAQMD) issued Abatement Order #2121-1. The document centered on leachate control surface emissions, gas migration, final cover, and inspection monitoring.
	State DOHS begins a health study of residents living near landfill site.
	Leachate recycling with incoming refuse began.

	Leachate control system (150 feet french drain) was set in place at northeast landfill area.
	Legislative hearing conducted by C.M. Calderon in Monterey Park regarding the OII landfill.
	OII claimed to stop all liquid waste disposal.
	SCAQMD discovered that OII had accepted 24 loads of liquid waste.
	Work began on a leachate control system near Iguala Park and the southwest corner of the landfill.
	Unannounced inspections were conducted by the DOHS to make sure OII was not accepting any more hazardous waste.
	SCAQMD discovers vinyl chloride in air on-site and in Iguala Park residential area.
	Vinyl chloride levels exceed state air quality minimum standard of 10 ppb (SCAQMD).
May, 1983	DOHS conducted additional unannounced inspections concerning continued acceptance of hazardous wastes at OII.
	Pool of leachate (was not sampled or analyzed) discovered in Iguala Park by SCAQMD. OII was given 48 hours to remedy situation.
	Construction began on six new pumping wells in the Iguala Park area since the leachate bleeds did not cease using the first leachate control well.
	Leachate bleeds occurred in the west and north-west sections of the landfill, and french-drain leachate control systems were installed.
	Leachate control work continued in the south-west corner of the landfill.
June, 1983	OII submitted a draft closure plan to State for review.
	EPA 3008 complaint/order sent to OII. Six Class I violations were covered in order including: - inadequate groundwater monitoring - no closure plan - no post-closure plan - no closure cost estimate - no post-closure cost estimate - no financial assurances

July, 1983	Iguala Park slope leachate bleeds disappeared. Two more water-leachate pumping wells (IG-4,5) have begun development.
	Leachate air-lift pump in landfills southwest corner malfunctioned and leachate overflow occurred.
	Consent agreement was signed by OII.
	OII agrees to pay $37,000 in fines to EPA.
	Revised OII closure/post-closure plan is resubmitted and financial assurance mechanism submittal was due August 15, 1983.
Aug., 1983	Lockman and Associates collect raw leachate sample which revealed 33 mg/l of vinyl chloride upon analysis.
Sept., 1983	EPA rejected OII financial assurance plan and established a resubmittal date of October 15, 1983.
Oct., 1983	DOHS conducted follow-up inspection to September 27, 1983. Found leachate problems in Iguala Park and southwest corner of the landfill. Also observed that landfill slopes around the leachate tanks exhibited significant signs of failure and erosion.
	SCAQMD conducted a Board Hearing regarding abatement order requirements and odor-emission control schedules for OII.
	OII was given until October 31, 1983, to submit Trust Agreement.
	EPA letter to OII indicates that DOHS would be the agency determining adequacy of submittals regarding RCRA closure.
Nov., 1983	Leachate appeared in Northwest corner near well L-19.
	OII submitted Trust Agreement to DOHS.
Dec., 1983	Leachate contamination is rediscovered in Greenwood Avenue area and other bleeds were found in Grid E-9.
	Grading operations began at the southwest corner "silverfill" area after trash deposition for this area was completed.
Jan., 1984	State DOHS announces the dump is now ranked as the 16th worst hazardous site out of a total of 97 in the state. LA County Superior Court issued order for OII to post a two million dollar bond by September 1, 1984.
May, 1984	3,520 gallons of vodka is disposed at the working face of the landfill.

	Irrigation begins on slopes near Iguala Park.
June, 1984	DOHS inspections reveals leachate seeps at southwest corner of OII.
	Several leachate bleeds off-site of southwest corner and Iguala Park.
July, 1984	Leachate contaminated dirt is removed from landfills west slope.
	Accepted Class II solid waste from Athens Disposal and Class III wastes from City of Monterey Park.
	Areas on north slope of landfill are irrigated.
Aug., 1984	Irrigation takes place at various locations throughout the landfill.
	Monterey Park City Council public hearing on OII application for an industrial waste permit to sewer pre-treated leachate through the City of Monterey Park. Application granted approval.
	California DOHS releases a Determination of Eminent or Substantial Endangerment Report which addresses leachate, gas, and slope problems and their subsequent monitoring and control. OII receives remedial Action Order #LA001 which deals with groundwater monitoring, gas migration, closure, and post closure.
Sept., 1984	Extensive irrigation takes place throughout the landfill.
	DOHS issues order to reduce recycling of leachate back into working face from 20,000 gallons per day to 10,000 gallons per day. Underground fire discovered in southeast corner of landfill. Fire was extinguished with 8,000 gallons of water.
	Redisposal of leachate into landfill ceases.
Oct., 1984	OII stops accepting refuse.
	OII begins shipping leachate off-site.
	OII placed on proposed National Priority List.
Nov., 1984	State and local agencies conduct methane gas survey in homes bordering on landfill.
Sept., 1984	SCAQMD issues a preliminary injunction against OII. The injunction required the continued operation and maintenance of the leachate collection system, continued trucking of collected leachate to a permitted off-site

	treatment facility and to proceed with plans and permitting for an on-site leachate pre-treatment facility.
Dec., 1985	OII declares it is financially unable to meet terms of the injunction.
May, 1986	EPA places OII landfill on the National Priority list of Uncontrolled Hazardous Waste Sites.
Sep., 1986	Monterey Park adds section 21.28.165 to their municipal code relating to disposition of wastes in the M zone.

APPENDIX C

OII SITE LEACHATE ANALYSIS (1983-1986)

APPENDIX C

OII LANDFILL LEACHATE ANALYSES (1983-1986)

A summary of the Operating Industries, Inc. leachate characterization data is presented in Table C-1. This data was reviewed and analyzed for the preparation of the Feasibility Study Report. The 70 sets of analytical results used to prepare the summary table represent a majority of the available data. A high quality analysis performed on a July 1986 sample of leachate by EPA's National Enforcement Investigations Center laboratory (NEIC) which is not included in Table C-1 is attached as Addendum C-1.

Leachate sample results used to prepare the table covered a period that extended from January 1983 through July 1986. Analytical reports on leachate quality were drawn from several regulatory agencies including the United States Environmental Protection Agency, California Regional Water Quality Control Board, California Department of Health Services, South Coast Air Quality Management District and the Los Angeles County Sanitation District. Also included in the data are analytical results obtained during treatability studies performed at the Triple J Pacification facility (ChemTech) and at Zimpro and results presented in reports on the site prepared by various consultants including Camp Dresser and McKee, Inc., Woodward Clyde Consultants and Lockman and Associates.

Leachate samples were taken from a variety of locations both on and off the Operating Industries, Inc., landfill site. Identified sampling locations include the leachate sump, underground collection tanks, above ground storage tanks, leachate transfer and dumping lines, vacuum trucks, bleeding landfill slopes, and holding tanks at off-site treatment facilities. Site stormwater analyses were not included in the summary. The NEIC leachate sample was collected from a spigot off of the transfer line leading from the underground tanks to the Baker tanks.

Several laboratories were used by the agencies and consultants to analyze the leachate from the landfill site. Analyses requested varied in frequency. Some test results, such as those for oil and grease, were reported for over fifty analyses. Other test results, such as ammonia were analyzed only once. Although neither the quality of results reported by each analyzing laboratory or the techniques used by those collecting the leachate for analysis could be verified for all tests, the majority of available data on leachate quality was included in the summary data compilation. EPA data validation procedures have not been done for the data.

Analytical data was reviewed to determine the total number of samples analyzed for each parameter, the range of reported values, the average level and the median value for each pollutant present in the leachate. The number of samples analyzed for specific organic constituents includes only those for which the level exceeded detection limits, whereas the number analyzed for other parameters includes those reported as below the limit of detection. As illustrated in Table C-1, the range of reported values for some pollutants was extremely wide, varying in some cases by several orders of magnitude. The mean and median values also differ significantly for several pollutants.

Available data was also reviewed to determine if any trends in reported pollutant levels with respect to time or change of seasons could be identified. Based on the 70 sets of results reviewed, no consistent pattern of changing leachate characteristics over the past three and one-half years or from season to season could be readily identified. A similar set of patternless results was observed even when data from the same identified sampling location were compared.

It should be noted that not every organic constituent detected in the leachate at any time is included in the attached table. All priority pollutant organic species identified in at least one sample are included; however, occasional monitoring data on volatile acids, normal biochemical metabolites in a landfill, are not included. Also, the general class of long chain alkanes which were determined to be present in the leachate in high concentrations (several hundred thousand micrograms per liter) although infrequently quantified, are not included.

TABLE C-1

OII LANDFILL SITE LEACHATE ANALYSES (1983-1986)

Parameter	No. of Samples	Range of Values (mg/l, except where noted) Minimum	Maximum	Mean	Median
Indicators					
pH	39	6.6	8.5 (s.u.)	7.6	7.6
COD (soluble)	1	3,624	—	3,624	3,624
COD (total)	42	750	31,000	7,144	4,690
BOD_5 (soluble)	1	78	—	78	78
BOD_5 (total)	2	191	218	205	—
TOC	3	450	1,180	759	646
DOC	1	1,352	—	1,352	1,352
OIL AND GREASE	53	6	296,800*	8,340	473
TURBIDITY	1	210 (NTU)	—	210	210
TOTAL SOLIDS	1	10,770	—	10,770	10,770
SUSPENDED SOLIDS	48	62	62,800*	3,532	628
ASH (total)	1	9,430	—	9,430	9,430
ASH (suspended)	1	14	—	14	14
TOTAL DISSOLVED SOLIDS	31	7,226	16,300	11,459	11,650
CONDUCTIVITY	2	14,560	22,000 (µmhos/cm)	18,280	—
COLOR	1	7,478 (A.P.H.A. Units)		7,478	7,478
SPECIFIC GRAVITY	16	1.00	1.02	1.02	1.02
SURFACTANTS	1	4.5	—	4.5	4.5
MERCAPTANS	2	0.42	1.2	0.81	—

TABLE C-1
(continued)
OII LANDFILL SITE LEACHATE ANALYSES (1983-1986)

Parameter	No. of Samples	Range of Values (mg/l except where noted) Minimum	Maximum	Mean	Median
Radioactivity					
RADIOACTIVITY - Gross Alpha	4	6.6±15	110.7 (pCi/L)	35	16
RADIOACTIVITY - Gross Beta	4	39	700±94 (pCi/L)	389	518
Wastewater					
SULFIDES	44	<0.01	13	2.1	1.2
CYANIDES	9	0.002	0.06	0.027	0.02
PHENOLS	4	1.15	33.3	10.3	4.71
TKN	1	763	—	763	763
AMMONIA	1	720	—	720	720
NITRATE	4	0.7	1,054	263.9	1.3
NITRITE	1	<0.5	—	<0.5	<0.5
PHOSPHATE	1	6.8	—	6.8	6.8
Water Quality					
CHLORIDE	4	22.6	4,924	3,416	4,013
FLUORIDE	3	0.3	58	19.8	1.1
CALCIUM	3	157	302	213	179

TABLE C-1
(continued)
OII LANDFILL SITE LEACHATE ANALYSES (1983-1986)

Parameter	No. of Samples	Range of Values (mg/l except where noted) Minimum	 Maximum	Mean	Median
Water Quality (continued)					
MAGNESIUM	3	116	367	232	212
HARDNESS	2	1,228	1,317	1,273	—
MANGANESE	4	0.82	162	41.6	2.5
IRON	4	9.74	87.6	44.7	28.5
POTASSIUM	3	470	640	528	470
SODIUM	3	2,200	4,500	3,567	4,000
SULFATE	3	<1.0	120	75.3	105
ALKALINITY	3	3,720	4,746	4,203	4,143
BICARBONATE	3	3,720	5,236	4,567	4,746
CARBONATE	1	<1.0	—	<1.0	<1.0
SILICA	1	21.0	—	21.0	21.0
Metals					
ALUMINUM	2	0.62	5.96	3.29	—
ANTIMONY	4	<0.002	0.031	0.015	<0.002
ARSENIC	21	0.026	4.52	0.37	0.12
BARIUM	13	<0.37	18	4.82	0.81
BERYLLIUM	2	<0.001	0.52	0.26	—
CADMIUM	22	<0.0006	0.405	0.035	<0.001

TABLE C-1
(continued)
OII LANDFILL SITE LEACHATE ANALYSES (1983-1986)

Parameter	No. of Samples	Range of Values (mg/l except where noted) Minimum	Maximum	Mean	Median
Metals (continued)					
CHROMIUM	22	<0.01	4.81	0.79	0.18
COBALT	10	<0.01	1.54	0.44	0.06
COPPER	23	<0.005	38	2.41	0.16
LEAD	23	<0.01	2.9	0.50	0.19
MERCURY	14	<0.0002	0.302	0.02	<0.002
NICKEL	23	<0.01	1.63	0.57	0.44
SELENIUM	14	<0.001	1.97	0.32	<0.001
SILVER	14	<0.001	0.096	0.04	<0.03
TELLURIUM	1	<0.01		<0.01	<0.01
THALLIUM	3	0.0062	0.17	0.06	0.006
TIN	3	<0.02	0.54	0.19	<0.02
VANADIUM	1	0.060	—	0.06	0.06
ZINC	23	0.06	18.0	3.10	0.95
BISMUTH	1	<0.02	—	<0.02	<0.02
MOLYBDENUM	1	<0.01	—	<0.01	<0.01
Organic					
TOX	2	0.0014	0.0091	0.0053	—

TABLE C-1
(continued)
OII LANDFILL SITE LEACHATE ANALYSES (1983-1986)

Parameter	No. of Samples	Range of Values (mg/l except where noted) Minimum	Maximum	Mean	Median
Priority Pollutant Organics Detected					
ACENAPHTHENE	1	0.066	—	0.066	0.066
ACRYLONITRILE	1	0.120	—	0.120	0.120
BENZENE	10	0.020	0.300	0.067	0.037
CHLOROBENZENE	1	0.030	—	0.030	0.030
1,2,4-TRICHLOROBENZENE	3	0.005	0.055	0.030	0.031
1,2-DICHLOROETHANE	4	0.001	0.29	0.162	0.075
1,1,1-TRICHLOROETHANE	4	0.002	1.25	0.359	0.150
1,1-DICHLOROETHANE	14	0.003	0.230	0.054	0.032
1,1,2,2-TETRACHLOROETHANE	1	0.160	—	0.160	0.160
4-CHLORO-3-METHYLPHENOL	3	0.020	0.081	0.052	0.054
CHLOROFORM	3	0.010	0.35	0.136	0.047
DICHLOROBENZENES (1,2)(1,3)(1,4)	14	0.021	3.89	0.520	0.140
2-CHLOROPHENOL	1	0.170	—	0.170	0.170
t-1,2-DICHLOROETHYLENE	2	0.010	0.026	0.018	—
2,4-DICHLOROPHENOL	2	0.051	2.10	1.076	—
2,4-DIMETHYLPHENOL	11	0.029	1.50	0.343	0.142
2,4-DINITROTOLUENE	1	0.070	—	0.070	0.070
ETHYLBENZENE	13	0.002	3.60	0.566	0.114

TABLE C-1
(continued)
OII LANDFILL SITE LEACHATE ANALYSES (1983-1986)

Parameter	No. of Samples	Range of Values (mg/l except where noted) Minimum	Maximum	Mean	Median
Priority Pollutant Organics Detected (continued)					
FLUORANTHENE	1	0.030	—	0.030	0.030
METHYLENE CHLORIDE	8	0.008	16.30	2.452	0.330
ISOPHORONE	1	0.900	—	0.900	0.900
NAPHTHALENE	12	0.010	1.20	0.186	0.059
4-NITROPHENOL	1	0.190	—	0.190	0.190
N-NITROSODI-N-PROPYLAMINE	1	0.075	—	0.075	0.075
PENTACHLOROPHENOL	3	0.029	0.230	0.118	0.095
PHENOL	12	0.012	1.80	0.397	0.150
BIS(2-ETHYLHEXYL)PHTHALATE	12	0.12	60.00	5.680	0.460
BUTYL BENZYL PHTHALATE	3	0.012	0.024	0.019	0.020
DI-N-BUTYL PHTHALATE	6	0.011	0.200	0.074	0.012
DI-N-OCTYL PHTHALATE	2	0.092	1.100	0.596	—
DIETHYLPHTHALATE	2	0.050	0.352	0.201	—
BENZO(a)ANTHRACENE	2	0.007	0.130	0.068	—
CHRYSENE	1	0.004		0.004	0.004
FLUORENE	3	0.012	0.120	0.109	0.088
PHENANTHRENE	11	0.020	0.900	0.183	0.110
PYRENE	3	0.002	0.099	0.058	0.074
TETRACHLOROETHYLENE	1	0.080		0.080	0.080

TABLE C-1
(continued)
OII LANDFILL SITE LEACHATE ANALYSES (1983-1986)

Parameter	No. of Samples	Range of Values (mg/l except where noted) Minimum	Maximum	Mean	Median
Priority Pollutant Organics Detected (continued)					
TOLUENE	17	0.055	10.0	1.148	0.340
TRICHLOROETHYLENE	2	0.060	0.320	0.19	—
VINYL CHLORIDE	7	0.009	0.50	0.114	0.057
PCB-1248	2	0.002	0.476	0.239	—
PCB-1260	3	0.005	0.296	0.121	0.062
Other Organics Detected					
ACETONE	6	0.150	3.00	1.202	0.770
METHYL ETHYL KETONE	6	0.040	5.00	0.954	0.090
METHYL ISOBUTYL KETONE	2	0.030	4.00	2.015	—
2-PENTANONE	1	DETECTED	—	—	—
4-METHYL-2-PENTANONE	5	0.051	1.9	0.525	0.060
2-HEXANONE	1	DETECTED	—	—	—
CYCLOHEXANONE	1	0.100	—	0.100	0.100
2-METHYLPHENOL	2	0.086	0.56	0.323	—
2,4,5-TRICHLOROPHENOL	1	0.320	—	0.320	0.320
DIMETHYL SULFIDE	1	DETECTED	—	—	—
XYLENE ISOMERS	16	0.020	5.00	1.017	0.239
DIOXANES	6	0.030	19.00	5.496	1.00

TABLE C-1
(continued)
OII LANDFILL SITE LEACHATE ANALYSES (1983-1986)

Parameter	No. of Samples	Range of Values (mg/l except where noted) Minimum	Maximum	Mean	Median
Other Organics Detected (continued)					
TETRAHYDROFURAN	7	0.050	0.800	0.396	0.530
FREON	1	9.40	—	9.40	9.40
2-METHYL NAPHTHALENE	6	0.012	0.890	0.206	0.013
CAMPHOR	1	0.960	—	0.960	0.960
N,N-DIMETHYL FORMAMIDE	1	0.120	—	0.120	0.120
c-1,2-DICHLOROETHYLENE	3	0.008	0.157	0.087	0.096

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*Samples were taken from the tank of a vacuum truck

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TO Thomas Dahl,
Project Coordinator

DATE September 16, 1986

FROM Dr. Joe Lowry, Chief JH Lowry
Inorganic Analytical Section

SUBJECT Analysis Results for the July, 1986 Operating Industries Site Samples,
Los Angeles, CA - NEIC Project D24

In July 1986, Ecology and Environment Inc., collected samples for EPA Region IX from the Leachate Tank, Well OI-4 and Well W-13 at the Operating Industries site near Los Angeles, California. The Leachate Tank was sampled in triplicate and Well OI-4 was sampled in duplicate. The Well OI-4 duplicate samples were "blind" duplicates and were labeled as from Well OI-7. These samples were analyzed by NEIC for the purposes of providing: 1) enforcement support, 2) accurate analytical results for a wide scope of parameters, 3) additional information regarding the chemical makeup of the samples, and 4) defensible analytical procedures and techniques.

This report presents the analytical results for a variety of analytes, discusses analytical difficulties caused by the sample matrices and provides modifications to standard methods to eliminate or circumvent these analytical difficulties. Some new information about the composition of the contaminants present in the samples is provided. Considerable information has been gathered about the composition of the organic constituents present in the samples beyond that obtained by the normal organic methods. However, analyses are still in progress in this area and the information will be reported as soon as it is compiled.

Field measurements, including conductance and pH, made by the sampling contractor at the time of sampling are not included in this report. The sampling contractor transferred samples to NEIC in accordance with standard chain of custody procedures.

Standard quality control measures were taken by NEIC in the analysis of the samples including but not limited to: (1) the analysis of field and laboratory blanks to allow distinction of possible contamination due to sample handling, (2) analysis of laboratory spiked samples and control samples to estimate accuracy, and (3) analysis of laboratory and field replicates to estimate precision. Table 1 provides a summary, by parameter, of the analytical techniques used for the sample analyses.

Table 2 lists the gas chromatographable organic constituents detected in the samples and Table 3 reports the limits of quantitation for compounds detected by the gas chromatography methods. Table 4 contains sample analysis results for alkalinity, free and total cyanide, bromide, chloride, fluoride, ammonia, nitrate, nitrite, phosphate, total phosphorus, sulfate and dissolved sulfur. The results of the sample analyses for thirty-three elements are contained in Table 5. Tables 6 through 12 report the results of the quality control measures for the particular analyses methods.

The following sections describe the analytical results obtained by NEIC. Consideration was given to problems a laboratory might encounter performing the analyses. The field blank analysis results do not appear in the data tables but are discussed where appropriate in the following sections.

Gas Chromatographable Organic Constituents

Table 2 lists the organic compounds which can be reported with certainty as being present in the samples from the volatile, semivolatile, pesticide and PCB analyses. This table only lists the compounds that were detected. Table 3 contains the limits of quantitation for the commonly determined volatile, semivolatile, pesticide and PCB organic compounds for which the methods are applicable. Those compounds listed in Table 3 and not reported in Table 2 were examined but not detected in the samples.

Large concentrations of 1,4-dioxane were found in the samples from the Leachate Tank and Well OI-4 samples. It was not detected in the Well W-13 sample. The results for 1,4-dioxane were obtained by purge and trap gas chromatography - mass spectroscopy (GC-MS). Although 1,4-dioxane has a rather poor purge efficiency, the GC-MS results were in excellent agreement with results obtained by direct injection gas chromatography with flame ionization detection.

Vinyl chloride and 1,2-dicloroethene can be present in contaminated waters as degradation products of trichlorethene. Vinyl chloride and 1,2-diclorethene were detected in the samples from the Leachate Tank and Well OI-4; trichloroethene was not detected. The absence of trichloroethene was confirmed by a manual search of the GC-MS data.

NEIC found 1200 ug/L methylene chloride in the Well W-13 sample. The 1200 ug/L value was obtained from the average analysis results of different dilutions of sample in a single sample bottle. The replicate analysis results ranged from 1130 ug/L to 1300 ug/L.

A number of other analyses verify the presence of the methylene chloride in the samples from Well W-13. In early September which was well after the recommended holding time for volatile organic analyses, other sample bottles for Well W-13 were analyzed for methylene chloride. The orginal and second volatile organics sample bottles and a purgable organic carbon sample bottle were analyzed. The analysis results ranged from 860 ug/L to 1000 ug/L. The purgable organic carbon sample bottle and volatile organic sample bottles were stored in different refrigerators in different laboratories and were not handled in the same laboratory prior to the late methylene chloride analyses. Further, although methylene chloride was detected at a concentration of 23 ug/L in the field blank and from 3.4 ug/L to 4.5 ug/L in the laboratory blanks, such levels are insignificant in comparison to the 1200 ug/L found in the Well W-13 sample. Additionally, although total organic halide (TOX) results will not be reported because the laboratory contracted by NEIC did not analyze the sample in accordance with the standard method or with the appropriate control measures or within appropriate holding times, the laboratory did report a TOX value of 400 ug/L for the Well W-13 sample. The TOX value is probably biased low substantially due to the practices used by the laboratory.

Dichlorobenzenes were found in both the volatile and semivolatile analyses for the Leachate Tank samples. The volatile analyses results are reported in Table 2 because the results are not subject to the semivolatile extraction difficulties which are discussed below and furthermore, a better detection limit was achieved for the volatile analyses.

The semivolatile chromatograms for the samples contained peaks for many compounds not listed in Table 3. Standards were available for some of these compounds and thus positive identification and quantitation was possible for the alkanes reported for the Leachate Tank samples and the methylbenzene compounds reported for the Leachate Tank and Well OI-4 samples. In addition, all semivolatile sample chromatograms contained large undifferentiated humps indicating the presence of weathered hydrocarbons. Based on the total ion count for the chromatograms, the hydrocarbon material was estimated to be about 70 mg/L for the Leachate Tank samples, 2 mg/L for the Well OI-4 sample and 13 mg/L for the Well W-13 sample. For comparison, the sum of the quantitated semivolatile compounds for the Leachate sample was 3 mg/L. Thus the majority of the organic material that chromatographs was hydrocarbon material whose specific compound makeup was not established.

As mentioned above methylene chloride was detected at 23 ug/L in the field blank. Other contaminant levels detected in the field blank were 126 ug/L of 2-butanone, 21 ug/L of acetone, 6 ug/L of tetrahydrofuran, 2 ug/L of ethyl acetate, 2 ug/L of hexanone and 0.4 ug/L of toluene. Contaminant levels found in the laboratory blanks were 10 ug/L to 16 ug/L of acetone, 8 ug/L to 9 ug/L of 2-butanone, 7 ug/L to 9 ug/L tetrahydrofuran, 3 ug/L to 5 ug/L of methylene chloride and less than 2 ug/L each of diethylphthalate, di-n-butylphthalate and bis(2-ethylhexyl)phthalate.

The results of the standard control measures to estimate the precision and accuracy of the analyses are reported in Tables 6 through 9. Tables 6 and 7 report the laboratory and field precision data, Table 8 reports the matrix spike recoveries and Table 9 reports the surrogate spike data. For concentrations well above the limit of quantitation, these control measure data indicate the sample results for the volatile organics should be within a few parts per billion or 10% of the actual concentration. For the semivolatile compounds the control measure results indicate the results should generally be within 50% of the actual concentration. The larger variability observed for semivolatile analysis is typical for the method.

For the volatile organics analysis, two factors limit the sample size. Foaming, especially for the Leachate Tank samples, limits the amount of sample that can be analyzed. For the Leachate Tank samples, NEIC analyzed 0.5 mL of sample diluted with 4.5 mL of blank water and for the other samples, 1.0 mL of sample was diluted with 4 mL of blank water. These sample volumes could possibly be doubled; however, if a larger sample volume is used the analyst must watch the purge and assure that the sample does not foam into the trap. Another problem with the volatile analysis is the high boiling point compounds present in the samples. Broad rolling peaks in the baseline are observed in subsequent analyses if these compounds are not cleaned off the column. Holding the gas chromatographic column at maximum temperature overnight cleaned off the compounds. Further, better baselines were obtained when the temperature program was extended so that the dichlorobenzene isomers eluted before the analysis was terminated. NEIC obtained much better precision and accuracy with the volatile analysis of the dichlorobenzene then with the semivolatile analysis.

The standard semivolatile method (Method 625) has the analyst raise the pH of the sample and extract with methylene chloride. The pH is then lowered and the sample is extracted again with methylene chloride. For samples containing high concentrations of dissolved inorganic material, raising the pH usually causes the formation of hydroxide precipitates. Often better recoveries of the organic compounds can be obtained by the reversing the normal pH adjustments.

Table 7 presents semivolatile compound results for the Leachate Tank samples using both types of extraction techniques. As indicated by the differences, with the exceptions of the more acid compounds (phenols and phthalates), more of the organic compounds were extracted with the "acid first" extraction technique then with the "base first" extraction. These samples were, however, unusual in that considerable precipitate or gel formation occurred when either acid or base was added, regardless of the pH adjustment order. Examination of this acidic formed precipitate by X-ray Fluorescence Spectroscopy found calcium, chlorine and silicon as major detectable elements and Infrared Spectroscopy analyses indicated that the precipitate had little organic character. Both procedures create emulsions; however, the "base first" technique created an emulsion that was easier to handle and thus it is recommended for this reason for future analyses.

The base/neutral fraction of the "base first" procedure contained some of the acid fraction compounds while no carry-over of the basic fraction compounds was observed in the acid/neutral fraction of the "acid first" procedure. As much as 2 mL to 4 mL of methylene chloride was observed for some samples to separate from the sample after the basic extraction when the sample pH was lowered. This volume should be added to the base/neutral fraction extract. All extract fractions were analyzed independently and not combined and this is recommended for future analyses of samples from these locations.

No pesticides or PCBs were detected in the samples and no unique analytical difficulties were encountered in the analysis of the samples for these parameters.

General Inorganic Constituents

General inorganic analysis results are given in Table 4. The results of the control measures for the parameter results reported in this table are presented in Table 10. The control data indicate the analysis results to be accurate within 10% of the actual concentrations.

No unique analytical difficulties were encountered for the ion chromatography analysis for the anions. The difference between the dissolved sulfur and the sulfate levels indicates the presence of other sulfur containing compounds. The presence of sulfite and thiosulfate would have been detected by the standard ion chromatography analysis. The low sulfate concentrations in the Leachate Tank samples were confirmed by mobile phase ion chromatography (MPIC). Further this MPIC analysis would have detected the presence of thiocyanate; however, thiocyanate was not detected in the samples. The sulfur compound(s) comprising the remainder of the dissolved sulfur remains unidentified.

The chloride and bromide levels were confirmed by inductively coupled plasma mass spectroscopy. Little difference was observed between the total phosphorus and the phosphate levels indicating that other phosphorus containing species are not present at large concentrations.

The Leachate Tank and Well OI-4 samples were found to contain large concentrations of ammonia. The samples were not distilled prior to analysis by the ion selective probe method. For the Leachate Tank samples large dilution of the samples was required to achieve accurate results. At lower dilutions known additions were not quantitatively recovered. The presence of surfactants in samples is noted by the probe manufacturer to cause results to be biased low due to wetting of gas permeable membrane of the probe. Headspace analysis for the Leachate Tank samples compared well with the direct analysis. The sensitivity of the headspace technique, however, was not adequate for the analysis of the groundwater samples. Distillation should be required for future analyses, and if the probe is used, quantitation should be performed using the known or standard addition method.

The tendency of the samples to froth under acidic conditions could cause erroneous results for total cyanide. Using standard practices for the distillation of cyanide caused vigorous frothing of the samples. For one of the samples from Well OI-4 the foam or micelles bumped over into the absorbing trap. Colorimetric analysis for this sample indicated the presence of 1,400 ug/L cyanide. The laboratory duplicate and triplicate values for Well OI-4, however, were found to contain about ten times less cyanide than indicated by the first analysis. Thus components in the sample that bumped over into the trap reacted with the colorimetric reagents resulting in an erroneous analysis result.

Low spike recoveries were initially obtained using standard practices for the distillation of cyanide. Usually low spike recoveries indicate that sample components reacted with the spiked cyanide. The formation of cyanohydrins from the reaction of aldehydes with cyanide is such a reaction. To determine if the heating of the total cyanide distillation might be accelerating the destruction of cyanide present in the sample, acidified fractions of the samples were purged and the evolved cyanide was trapped. The total cyanide apparatus and reagents were used for this analysis; however, no heat was applied. The results of these analyses are reported in Table 4 as "Free Cyanide". If the free cyanide results were greater than the total cyanide values, it could be concluded that sample components were reacting with cyanide. However, this was not the case. Good spike recoveries and reproducible results can be obtained for the total cyanide analysis. When distilling the samples, the sulfuric acid must be added very slowly in the absence of heat to avoid the frothing and bumping over into the trap. With the carrier gas flowing, one should wait about fifteen minutes before applying heat to the distillation system. The formation of the micelles seems to lessen after the samples have been acidified and purged for a little while. Purging the sample prior to heating may also outgas the interferent. The distillations should still be watched carefully to assure that the foam does not bump over.

Elemental Constituents

Table 5 presents the results of the analysis of the samples for thirty-three elements. Dissolved and total elemental concentrations were determined for twenty-seven elements. Only dissolved concentrations were determined for boron, lithium, iodine, silicon and uranium. Since no total mercury was detected, dissolved mercury was not determined. Tables 11 and 12 provide control measure data indicating that the sample results, for concentrations substantially greater the limits of detection, are reliable to within 10% of the actual concentrations.

Many of the elements were determined in accordance with Method 200.7 using Inductively Coupled Argon Plasma Optical Emission Spectroscopy (ICAP-OES). Difficulties in the analysis are created by the high dissolved solids and the surfactants present in the samples. Interference due to these components was detected by unusually low and high spike recoveries and a substantial increase in the background emission. The common approach of diluting the samples until the interference is not observed was unacceptable because the concentrations of many of the elements would have been diluted below or near the detection limit of the method. The interference manifests changes relative to the calibration in the spatial emission profiles of the atoms or ions within the plasma for the samples. This interference causes either a rotational error or a translational error relative to the calibration curve.

For example, the curve established from standard additions to the Well OI-4 samples for nickel had a slope 1.3 times greater than calibration curve for nickel. For silver the standard addition slope was 1.6 times greater than the silver calibration. The standard addition slope did not always increase. For example the standard addition curve for iron had a slope of 0.75 times the calibration curve slopes. Further the magnitude of interference effect varied with the samples. Thus standard additions were required for most of elements for all of the samples. The majors including calcium, magnesium, potassium and sodium did not require standard additions as the samples, excluding the Well W-13 sample for potassium, had to be diluted to bring the major element concentrations within the linear range of the analytical lines. Standard additions were performed for the majors but they were not needed. For future analyses of the samples from these locations, the method of standard additions instead of the normal calibration curve method should be used for the trace and minor elemental constituents determined by ICAP-OES.

Similarly, standard additions were required for the Inductively Coupled Argon Plasma Mass Spectroscopy analyses and were performed for the hydride generation coupled to ICAP-OES analyses. For the hydride method, antimony and arsenic did not need the standard additions; however, the analysis of selenium did have some suppression of the signal for the Leachate Tank samples.

We had hoped to study problems with furnace atomic absorption spectroscopy (AAS) analyses of the samples as suppression and interference is highly likely for these sample matrices. Unfortunately, our instrument was not in service at an opportune time when an experienced chemist could have studied the possible difficulties. Often contract laboratories use deuterium arc background corrected AAS. However, it is believed that deuterium arc background correction would not be able to correct the high salt background that would be encountered for these samples or be able to correct for interference of iron on selenium. A contract laboratory analyzing these samples by furnace AAS should be required to use Zeeman Effect background correction and use a L'vov platform in the furnace. Further, matrix modifiers should be required to be used and all analysis should be performed using standard additions to quantitate. Nickel should be added as a matrix modifier for arsenic and selenium, phosphoric acid for lead, phosphate for cadmium and platinum or palladium for thallium and perhaps even cadmium.

The high organic content of the samples causes difficulties for the mercury analyses. Using the normal 100 mL aliquot in the digestion, a spike recovery of only about 50% was obtained for the Well OI-4 sample. By decreasing the sample aliquot to 10 mL, the spike recovery increased to 82%, and at 5 mL of sample the recovery increased to 94%. The capacity of the digestion reagents was apparently exceeded by the organic load of the samples at the higher sample volumes. The samples were analyzed using 10 mL sample aliquots which for future analyses should be reduced to 5 mL based on the spike recovery data. For some contract laboratories, the lower sample volume will compromise the detection limit and depending on the path length of the analyzer the detection limit could easily be greater then the drinking water limit of 2 ug/L.

The field blank for the dissolved constituents contained two significant contaminants. Selenium was found at a concentration of 40 ug/L and lead was found at 6 ug/L. No significant contamination was detected in the field blank for the total constituents.

Table 1

Sample Preparation and Analysis Techniques
Operating Industries, Los Angeles, CA
NEIC Project D24

Parameter	Preparation Technique	Analysis Technique
Specific Organic Constituents		
Volatiles	Purge and trap	Gas Chromatography - Mass Spectroscopy
	Direct injection	Gas Chromatography with Flame Ionization Detection
Semi-volatiles	Methylene chloride extraction	Gas Chromatography - Mass Spectroscopy
Pesticides/PCB	Methylene chloride/hexane extraction	Gas Chromatography with Electron Capture Detection
General Inorganic Constituents		
Alkalinity	None	Titrimetry
Ammonia	Filtration, Acidification	Ion Selective Potentiometry
Bromide	Filtration	Ion Chromatography
Chloride	Filtration	Ion Chromatography
Flouride	Filtration	Ion Selective Potentiometry
Nitrate	Filtration	Ion Chromatography
Nitrite	Filtration	Ion Chromatography
Phosphate	Filtration	Ion Chromatography
Phosphorus	Wet Digestion	Inductively Coupled Plasma Emission Spectroscopy
Sulfate	Filtration	Ion Chromatography
Sulfur	Filtration	Inductively Coupled Plasma Emission Spectroscopy
Free Cyanide	Acidification, purge, caustic trap	Pyridine Barbituric Acid Automated Colorimetry
Total Cyanide.	Manual distillation	Pyridine Barbituric Acid Automated Colorimetry
Elemental Constituents		
B, Li and U	Filtration, acidification	Inductively Coupled Plasma Mass Spectroscopy
Mercury	Wet digestion	Cold Vapor Atomic Absorption Spectroscopy
Sb, As and Se	Wet digestion	Hydride-Inductively Coupled Plasma Emission Spectroscopy
Pb and Tl	Acid digestion for total	Inductively Coupled Plasma Mass Spectroscopy
Other Elements	Acid digestion for total	Inductively Coupled Plasma Emission Spectroscopy

Table 2

Volatile and Semivolatile Organic Constituents Analysis Results
Operating Industries, Los Angeles, CA
NEIC Project D24

Station:	Leachate	Well OI-4	Well OI-7	Well W-13
Compound	Value, ug/L	Value, ug/L	Value, ug/L	Value, ug/L
Volatile Compounds				
Methylene chloride	ND a	ND	ND	1,200.
Vinyl chloride	20. b	200.	240.	ND
trans-1,2-Dichloroethene	40. b	20.	20.	ND
Benzene	60.	3. b	6. b	6. b
1,2-Dichlorobenzene	80.	ND	ND	ND
1,4-Dichlorobenzene	40.	ND	ND	ND
Toluene	100.	ND	ND	ND
m-Xylene	160.	ND	ND	ND
o-, or p-Xylene	240.	ND	10. b	ND
1,4-Dioxane	13,000.	22,000.	23,000.	ND
Tetrahydrofuran	500.	ND	ND	ND
2-Methyl-2-butanol	1,400.	ND	ND	ND
2-Methyl-2-propanol	2,000.	250.	260.	ND
4-Methyl-2-pentanone	50. b	ND	ND	ND
Semivolatile Compounds				
Aniline	30. b	ND	ND	ND
bis(2-Ethylhexyl)phthalate	1,100.	ND	ND	ND
Naphthalene	40. b	ND	ND	ND
2-Methylnaphthalene	90.	ND	ND	ND
Phenanthrene	40. b	ND	ND	ND
Phenol	70. b	ND	ND	ND
2-Methylphenol	160. b	ND	ND	ND
4-Methylphenol	500.	ND	ND	ND
2,4-Dimethylphenol	400.	ND	ND	ND
n-Undecane	330.	ND	ND	ND
n-Dodecane	170.	ND	ND	ND
n-Tridecane	210.	ND	ND	ND
n-Tetradecane	210.	ND	ND	ND
n-Pentadecane	160.	ND	ND	ND
n-Heptadecane	270.	ND	ND	ND
n-Nonadecane	80. b	ND	ND	ND
1,3,5-Trimethylbenzene	50. b	1. b	3. b	ND
1,2,3-Trimethylbenzene	50. b	5. b	7. b	ND
1,2,4,5-Tetramethylbenzene	110.	6. b	ND	ND
LOQ Factors (c)				
Volatiles	10X	5X	5X	5X
Acid Semivolatiles	20X	2X	2X	2X
Neutral Semivolatiles	20X	2X	2X	2X
Base Semivolatiles	10X	2X	2X	2X
Pesticides	4X	1X	1X	1X

a) Compound was not detected.
b) Estimated concentration. Compound was detected but the concentration was below the Limit Of Quantitation (LOQ).
c) LOQ factors are the factors needed to correct the LOQs given in Table 3 for analysis dilution.

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Table 3

Specific Organic Constituents Analysis Limits of Quantitation (a)
Operating Industries, Los Angeles, CA
NEIC Project D24

Volatile Compounds	ug/L
Bromomethane	4.
Chloromethane	10.
Bromodichloromethane	2.
Dibromochloromethane	2.
Bromoform	2.
Chloroform	6.
Carbon tetrachloride	2.
Carbon disulfide	5.
Chloroethane	6.
1,2-Dibromoethane	10.
1,1-Dichloroethane	4.
1,2-Dichloroethane	4.
1,1,1-Trichloroethane	2.
1,1,2-Trichloroethane	2.
1,1,2,2-Tetrachloroethane	6.
1,1-Dichloroethene	6.
trans-1,2-Dichloroethene	6.
Trichloroethene	4.
Tetrachloroethene	2.
Methylene chloride	6.
Vinyl chloride	10.
1,2-Dichloropropane	2.
1,2-Dibromo-3-chloropropane	10.
cis-1,3-Dichloropropene	5.
trans-1,3-Dichloropropene	5.
Benzene	2.
Chlorobenzene	2.
1,2-Dichlorobenzene	4.
1,3-Dichlorobenzene	4.
1,4-Dichlorobenzene	4.
Toluene	2.
m-Xylene	4.
o-, or p-Xylene	4.
Ethylbenzene	2.
2-Propanol	60.
2-Methyl-2-propanol	40.
2-Butanol	40.
4-Methyl-2-butanol	20.
4-Methyl-2-pentanol	20.
4-Methyl-2-penten-2-ol	100.
Acetone	40.
2-Butanone	30.
2-Hexanone	20.
4-Methyl-2-pentanone	10.
Ethyl ether	10.
2-Chloroethylvinylether	40.
Tetrahydrofuran	30.
Pyridine	100.
1,4-Dioxane	500.
Styrene	10.
Vinyl acetate	10.

Semi-Volatile Compounds	ug/L
Aniline	6.
4-Chloroaniline	6.
2-Nitroaniline	7.
3-Nitroaniline	9.
4-Nitroaniline	9.
Benzyl alcohol	4.
Benzyl chloride	4.
1,2-Dichlorobenzene	4.
1,3-Dichlorobenzene	6.
1,4-Dichlorobenzene	4.
1,2,4-Trichlorobenzene	5.
1,2,4,5-Tetrachlorobenzene	5.
1,2,3,4-Tetrachlorobenzene	4.
Pentachlorobenzene	5.
Hexachlorobenzene	6.
Nitrobenzene	5.
2,4-Dinitrotoluene	8.
2,6-Dinitrotoluene	8.
N-Nitrosodiphenylamine	5.
N-Nitroso-di-n-propylamine	5.
bis(2-Chloroethyl)ether	6.
bis(2-Chloroisopropyl)ether	6.
bis(2-Chloroethoxy)methane	6.
4-Bromophenyl-phenylether	5.
4-Chlorophenyl-phenylether	7.
Hexachloroethane	8.
Hexachlorobutadiene	14.
Hexachlorocylcopentadiene	12.
Dimethylphthalate	15.
Diethylphthalate	8.
di-n-Butylphthalate	4.
di-n-Octylphthalate	9.
bis(2-Ethylhexyl)phthalate	8.
Butylbenzylphthalate	6.
Acenaphthene	4.
Acenaphthylene	5.
Anthracene	4.
Benzo(a)anthracene	5.
Benzo(b)fluoranthene	11.
Benzo(k)fluoranthene	6.
Benzo(g,h,i)perylene	9.
Benzo(a)pyrene	7.
Chrysene	4.
Dibenzo(a,h)anthracene	8.
Dibenzofuran	5.
Fluoranthene	6.
Fluorene	5.
Indeno(1,2,3-cd)pyrene	7.
Isophorone	4.
Naphthalene	4.
2-Chloronaphthalene	4.
2-Methylnaphthalene	4.
Phenanthrene	4.
Pyrene	7.

Semi-Volatile Compounds	ug/L
Benzoic acid	22.
Phenol	5.
2-Chlorophenol	4.
2,4-Dichlorophenol	5.
2,4,5-Trichlorophenol	9.
2,4,6-Trichlorophenol	7.
Pentachlorophenol	5.
4-Chloro-3-methylphenol	4.
2-Methylphenol	5.
4-Methylphenol	5.
2,4-Dimethylphenol	10.
4,6-Dinitro-2-methylphenol	5.
2-Nitrophenol	6.
4-Nitrophenol	11.
2,4-Dinitrophenol	11.

Pesticides and PCBs	ug/L
Aldrin	0.5
alpha-BHC	0.5
beta-BHC	0.5
gamma-BHC	0.5
delta-BHC	0.5
Chlordane	2.
4,4'-DDD	1.
4,4'-DDE	0.5
4,4'-DDT	1.
Dieldrin	0.5
Endosulfan I	0.5
Endosulfan II	0.5
Endosulfan sulfate	1.
Endrin	0.5
Endrin aldehyde	0.5
Endrin ketone	0.5
Heptachlor	1.
Heptachlor epoxide	0.5
Methoxychlor	1.
Toxaphene	5.
PCB-1016	5.
PCB-1221	10.
PCB-1232	5.
PCB-1242	5.
PCB-1248	5.
PCB-1254	5.
PCB-1260	5.

a) Multiply the Table 2 LOQ factors times the Table 3 values to obtain the LOQ values for each sample.

Table 4

General Inorganic Constituent Analysis Results
Operating Industries, Los Angeles, CA
NEIC Project 824

Parameter	Station: Units	Leachate Tank Value	Well 01-4 Value	Well 01-7 Value	Well W-13 Value	LOD (a)
Alkalinity	meq/L	80.6	32.	33.1	19.1	0.02
Free Cyanide	mg/L CN	20.	40.	20.	40.	20.
Total Cyanide	mg/L CN	40.	120.	80.	110.	20.
Bromide	mg/L	47.	71.	71.	20.	1.
Chloride	mg/L	6,300.	4,930.	4,910.	2,700.	0.2
Fluoride	mg/L	0.97	0.66	0.66	0.44	0.01
Ammonia	mg/L N	927.	44.	42.	1.0	0.02
Nitrate	mg/L N	ND b	99.	90.	ND	0.4
Nitrite	mg/L N	ND	ND	ND	ND	0.1
Phosphate	mg/L P	5.3	ND	ND	ND	0.3
Total Phosphorus	mg/L P	6.0	ND	ND	0.6	0.3
Sulfate	mg/L SO4=	6.	310.	316.	220.	0.8
Sulfate	mg/L S	2.	103.	105.	73.	0.3
Dissolved Sulfur	mg/L S	56.	130.	111.	107.	0.2

a) Limit of Detection.
b) Sample concentration was not detected at the listed LOD.

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Table 5

Dissolved and Total Elemental Constituents Analysis Results
Operating Industries, Los Angeles, CA
NEIC Project D24

Elmt	Leachate Dissolved Value, ug/L	Leachate Total Value, ug/L	Well 01-4 Dissolved Value, ug/L	Well 01-4 Total Value, ug/L	Well 01-7 Dissolved Value, ug/L	Well 01-7 Total Value, ug/L	Well W-13 Dissolved Value, ug/L	Well W-13 Total Value, ug/L	LOD (a) ug/L
Al	400.	500.	ND b	3,200.	ND	3,100.	ND	ND	100.
Sb	ND	ND	ND	ND	ND	ND	ND	ND	8.
As	70.	72.	ND	36.	ND	32.	55.	77.	6.
Ba	905.	1,060.	467.	557.	454.	951.	415.	1,000.	10.
Be	ND	ND	ND	ND	ND	ND	ND	ND	6.
B	15,400.	NA c	9,170.	NA	9,370.	NA	9,630.	NA	10.
Cd	6.	5.	ND	ND	ND	ND	ND	ND	4.
Ca	154,000.	159,000.	496,000.	510,000.	471,000.	502,000.	425,000.	478,000.	20.
Cr	95.	110.	ND	ND	ND	ND	ND	ND	30.
Co	50.	40.	60.	70.	60.	70.	20.	20.	10.
Cu	5.	7.	122.	131.	106.	114.	ND	66.	4.
I	5,550.	NA	2,390.	NA	2,330.	NA	2,350.	NA	5.
Fe	14,300.	16,000.	2,160.	22,300.	440.	17,000.	16,000.	29,400.	10.
Pb	14.	10.	5.	11.	4.	11.	ND	14.	1.
Li	53.9	NA	4.4	NA	3.8	NA	4.9	NA	0.5
Mg	320,000.	330,000.	525,000.	553,000.	508,000.	545,000.	210,000.	305,000.	10.
Mn	1,100.	1,300.	2,900.	3,230.	2,790.	3,090.	11,000.	13,900.	3.
Hg	NA	ND	NA	ND	NA	ND	NA	ND	0.5
Mo	ND	ND	ND	ND	ND	ND	ND	ND	20.
Ni	330.	340.	470.	450.	450.	460.	40.	40.	20.
K	676,000.	697,000.	103,000.	106,000.	180,000.	182,000.	7,420.	7,420.	200.
Sc	ND	ND	ND	ND	ND	ND	ND	ND	2.
Se	ND	ND	ND	ND	ND	ND	ND	ND	7.
Si	10,300.	NA	6,000.	NA	7,000.	NA	28,900.	NA	100.
Ag	ND	ND	ND	ND	ND	ND	ND	ND	10.
Na	3,120,000.	3,000,000.	2,970,000.	3,120,000.	2,960,000.	3,070,000.	1,120,000.	1,130,000.	70.
Sr	2,290.	2,390.	6,360.	7,530.	6,170.	7,410.	3,840.	4,650.	30.
Tl	ND	ND	ND	ND	ND	ND	ND	ND	0.7
Ti	54.	82.	11.	271.	10.	261.	20.	39.	4.
U	ND	NA	60.7	NA	61.7	NA	7.2	NA	0.3
V	74.	105.	104.	107.	88.	166.	41.	67.	4.
Y	ND	ND	ND	ND	ND	ND	ND	ND	6.
Zn	70.	107.	110.	157.	120.	147.	73.	170.	4.

a) Limit Of Detection.
b) Element concentration was less than the LOD at 99% certainty.
c) Sample was not analyzed for this element.

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Table 6

Volatile Organic Constituent Analysis Precision Report
Operating Industries, Los Angeles, CA
NEIC Project 024

Compounds Detected	Station	Replicate Type	Average ug/L	% RSD (a)
Methylene chloride	W-11	Lab	1,210.	9.6
Vinyl chloride	01-4	Lab	202.	4.1
Vinyl chloride	Leachate	Field	16.9	30.8
trans-1,2-Dichloroethene	01-4	Lab	24.9	5.1
trans-1,2-Dichloroethene	Leachate	Field	41.4	15.1
Benzene	01-4	Lab	2.8	18.1
Benzene	Leachate	Field	55.9	19.8
1,2-Dichlorobenzene	Leachate	Field	81.0	33.5
1,4-Dichlorobenzene	Leachate	Field	42.7	17.3
Toluene	Leachate	Field	103.	59.7
m-Xylene	Leachate	Field	162.	19.1
o-, or p-Xylene	Leachate	Field	243.	9.4
2-Methyl-2-propanol	01-4	Lab	240.	10.6
2-Methyl-2-propanol	Leachate	Field	1,770.	5.3
2-Methyl-2-butanol	Leachate	Field	1,430.	8.1
4-Methyl-2-pentanone	Leachate	Field	50.9	30.4
Tetrahydrofuran	Leachate	Field	479.	3.4
1,4-Dioxane	01-4	Lab	22,400.	10.3
1,4-Dioxane	Leachate	Field	12,700.	6.5

a) Percent relative standard deviation for triplicate analyses.

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Table 7

Semivolatile Organic Analysis Results
for the Leachate using Different Extraction Techniques
Operating Industries, Los Angeles, CA
NEIC Project D24

Compound	Acid First Value, ug/L	Base First Value, ug/L	Acid - Base Difference, ug/L	Average Value, ug/L	% RD (a)
Sample Components					
Phenol	34.	71.	-37.	52.	71.
2-Methylphenol	96.	160.	-64.	130.	49.
4-Methylphenol	351.	504.	-153.	430.	36.
2,4-Dimethylphenol	392.	416.	-24.	400.	6.0
bis(2-Ethylhexyl)phthalate	1030.	1100.	-70.	1070.	6.5
di-n-Octylphthalate	33.	74.	-41.	54.	76.
Aniline	34.	29.	5.	31.	16.
1,2-Dichlorobenzene	73.	57.	16.	65.	25.
1,4-Dichlorobenzene	34.	ND b	34.	NC c	
Naphthalene	42.	34.	8.	38.	21.
2-Methylnaphthalene	88.	77.	11.	83.	13.
Phenanthrene	38.	38.	0.	38.	0.3
n-Undecane	334.	108.	226.	220.	103.
n-Dodecane	167.	112.	55.	140.	39.
n-Tridecane	215.	124.	91.	170.	54.
n-Tetradecane	206.	201.	5.	200.	2.5
n-Pentadecane	157.	121.	36.	140.	26.
n-Heptadecane	273.	174.	99.	220.	45.
n-Nonadecane	76.	62.	14.	69.	20.
1,2,3-Trimethylbenzene	50.	42.	8.	46.	17.
1,3,5-Trimethylbenzene	47.	39.	8.	43.	19.
1,2,4,5-Tetramethylbenzene	113.	84.	29.	99.	29.
Spiked Surrogate					
d3-Phenol	130.	200.	-70.	173.	40.
d5-Phenol	327.	595.	-268.	461.	58.
2-Fluorophenol	474.	928.	-454.	701.	65.
2,4,6-Tribromophenol	1200.	1970.	-770.	1590.	48.
d4-1,4-Dichlorobenzene	33.	33.	0.	33.	0.
d5-Nitrobenzene	467.	374.	93.	421.	22.
2-Fluorobiphenyl	350.	296.	54.	323.	17.
d14-Terphenyl	488.	466.	22.	477.	4.6
d10-Acenaphthene	41.	36.	5.	39.	13.

a) Percent relative difference.
b) Not detected.
c) Not calculated.

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Table 8

Specific Organic Constituents Matrix Spike Recovery Report
Operating Industries, Los Angeles, CA
NEIC Project 024

Compound Spiked	Spiked Sample	Spike Level, ug/L	Spike Recovery	Compound Spiked	Spiked Sample	Spike Level, ug/L	Spike Recovery
Bromomethane	01-4	125.	112.	Trichloroethene	01-4	125.	106.
Chloromethane	01-4	125.	66.	Tetrachloroethene	01-4	125.	115.
Bromodichloromethane	01-4	125.	100.	Methylene chloride	01-4	125.	90.
Dibromochloromethane	01-4	125.	99.	Vinyl chloride	01-4	125.	80.
Bromoform	01-4	125.	104.	1,2-Dichloropropane	01-4	125.	90.
Chloroform	01-4	125.	103.	Benzene	01-4	125.	97.
Carbon tetrachloride	01-4	125.	107.	Chlorobenzene	01-4	125.	103.
Chloroethane	01-4	125.	111.	Toluene	01-4	125.	102.
1,1-Dichloroethane	01-4	125.	107.	m-Xylene	01-4	125.	103.
1,2-Dichloroethane	01-4	125.	105.	o-, or p-Xylene	01-4	125.	106.
1,1,1-Trichloroethane	01-4	125.	107.	Ethylbenzene	01-4	125.	100.
1,1,2-Trichloroethane	01-4	125.	104.	2-Butanone	01-4	125.	99.
1,1,2,2-Tetrachloroethane	01-4	125.	112.	2-Hexanone	01-4	125.	71.
1,1-Dichloroethene	01-4	125.	100.	Tetrahydrofuran	01-4	125.	97.
trans-1,2-Dichloroethene	01-4	125.	101.				
Aniline	01-7	200.	84.	Hexachlorocylcopentadiene	01-7	200.	43.
4-Chloroaniline	01-7	200.	11.	Dimethylphthalate	01-7	200.	72.
2-Nitroaniline	01-7	200.	55.	Diethylphthalate	01-7	200.	74.
3-Nitroaniline	01-7	200.	0.	di-n-Butylphthalate	01-7	200.	82.
4-Nitroaniline	01-7	200.	0.	di-n-Octylphthalate	01-7	200.	213.
Benzyl alcohol	01-7	200.	79.	bis(2-Ethylhexyl)phthalate	01-7	200.	119.
Benzyl chloride	01-7	200.	79.	Butylbenzylphthalate	01-7	200.	131.
1,2-Dichlorobenzene	01-7	200.	63.	Acenaphthene	01-7	200.	66.
1,3-Dichlorobenzene	01-7	200.	56.	Acenaphthylene	01-7	200.	69.
1,4-Dichlorobenzene	01-7	200.	61.	Anthracene	01-7	200.	73.
1,2,4-Trichlorobenzene	01-7	200.	62.	Benzo(a)anthracene	01-7	200.	89.
1,2,4,5-Tetrachlorobenzene	01-7	200.	60.	Benzo(b)fluoranthene	01-7	200.	114.
1,2,3,4-Tetrachlorobenzene	01-7	200.	61.	Benzo(k)fluoranthene	01-7	200.	116.
Pentachlorobenzene	01-7	200.	65.	Benzo(a)pyrene	01-7	200.	106.
Hexachlorobenzene	01-7	200.	66.	Benzo(g,h,i)perylene	01-7	200.	71.
Nitrobenzene	01-7	200.	113.	Chrysene	01-7	200.	78.
2,4-Dinitrotoluene	01-7	200.	88.	Dibenzo(a,h)anthracene	01-7	200.	80.
2,6-Dinitrotoluene	01-7	200.	92.	Dibenzofuran	01-7	200.	68.
N-Nitrosodiphenylamine	01-7	200.	88.	Fluoranthene	01-7	200.	73.
N-Nitroso-di-n-propylamine	01-7	200.	83.	Fluorene	01-7	200.	75.
bis(2-Chloroethyl)ether	01-7	200.	84.	Indeno(1,2,3-cd)pyrene	01-7	200.	81.
bis(2-Chloroisopropyl)ether	01-7	200.	84.	Isophorone	01-7	200.	87.
bis(2-Chloroethoxy)methane	01-7	200.	78.	Naphthalene	01-7	200.	64.
4-Bromophenyl-phenylether	01-7	200.	71.	2-Chloronaphthalene	01-7	200.	67.
4-Chlorophenyl-phenylether	01-7	200.	67.	2-Methylnaphthalene	01-7	200.	75.
Hexachloroethane	01-7	200.	44.	Phenanthrene	01-7	200.	73.
Hexachlorobutadiene	01-7	200.	40.	Pyrene.	01-7	200.	95.

Table 8 (continued)

Specific Organic Constituents Matrix Spike Recovery Report
Operating Industries, Los Angeles, CA
NEIC Project 824

Compound Spiked	Spiked Sample	Spike Level, ug/L	Spike Recovery	Compound Spiked	Spiked Sample	Spike Level, ug/L	Spike Recovery
Benzoic acid	OI-7	200.	69.	4-Chloro-3-methylphenol	LTB	1000.	95.
Benzoic acid	OI-4	200.	23.	4-Chloro-3-methylphenol	LTA	2000.	107.
Benzoic acid	LTB	1000.	80.	2-Methylphenol	OI-7	200.	74.
Benzoic acid	LTA	2000.	86.	2-Methylphenol	OI-4	200.	92.
Phenol	OI-7	200.	50.	2-Methylphenol	LTB	1000.	106.
Phenol	OI-4	200.	55.	2-Methylphenol	LTA	2000.	115.
Phenol	LTB	1000.	56.	4-Methylphenol	OI-7	200.	64.
Phenol	LTA	2000.	57.	4-Methylphenol	OI-4	200.	86.
2-Chlorophenol	OI-7	200.	83.	4-Methylphenol	LTB	1000.	101.
2-Chlorophenol	OI-4	200.	107.	4-Methylphenol	LTA	2000.	110.
2-Chlorophenol	LTB	1000.	107.	2,4-Dimethylphenol	OI-7	200.	50.
2-Chlorophenol	LTA	2000.	113.	2,4-Dimethylphenol	OI-4	200.	30.
2,4-Dichlorophenol	OI-7	200.	79.	2,4-Dimethylphenol	LTB	1000.	94.
2,4-Dichlorophenol	OI-4	200.	89.	2,4-Dimethylphenol	LTA	2000.	125.
2,4-Dichlorophenol	LTB	1000.	91.	4,6-Dinitro-2-methylphenol	OI-7	200.	97.
2,4-Dichlorophenol	LTA	2000.	96.	4,6-Dinitro-2-methylphenol	OI-4	200.	135.
2,4,5-Trichlorophenol	OI-7	200.	77.	4,6-Dinitro-2-methylphenol	LTB	1000.	130.
2,4,5-Trichlorophenol	OI-4	200.	89.	4,6-Dinitro-2-methylphenol	LTA	2000.	133.
2,4,5-Trichlorophenol	LTB	1000.	94.	2-Nitrophenol	OI-7	200.	99.
2,4,5-Trichlorophenol	LTA	2000.	96.	2-Nitrophenol	OI-4	200.	96.
2,4,6-Trichlorophenol	OI-7	200.	75.	2-Nitrophenol	LTB	1000.	99.
2,4,6-Trichlorophenol	OI-4	200.	91.	2-Nitrophenol	LTA	2000.	101.
2,4,6-Trichlorophenol	LTB	1000.	97.	4-Nitrophenol	OI-7	200.	47.
2,4,6-Trichlorophenol	LTA	2000.	99.	4-Nitrophenol	OI-4	200.	53.
Pentachlorophenol	OI-7	200.	97.	4-Nitrophenol	LTB	1000.	51.
Pentachlorophenol	OI-4	200.	90.	4-Nitrophenol	LTA	2000.	52.
Pentachlorophenol	LTB	1000.	73.	2,4-Dinitrophenol	OI-7	200.	109.
Pentachlorophenol	LTA	2000.	75.	2,4-Dinitrophenol	OI-4	200.	151.
4-Chloro-3-methylphenol	OI-7	200.	91.	2,4-Dinitrophenol	LTB	1000.	130.
4-Chloro-3-methylphenol	OI-4	200.	93.	2,4-Dinitrophenol	LTA	2000.	142.
Aldrin	OI-7	2.	91.	4,4'-DDD	OI-7	2.	100.
gamma-BHC	OI-7	2.	95.	Heptaclor	OI-7	2.	90.

Table 9

Volatile and Semivolatile Organic Constituents Analysis Surrogate Spike Recovery Report
Operating Industries, Los Angeles, CA
NEIC Project D24

Compound Spiked	Amount Spiked	Number of Analyses	Recovery Range, %	Average Recovery, %	% RSD (a)
Bromochloromethane	250. ng	10	97. to 104.	100.	2.5
Bromofluorobenzene	50. ng	10	95. to 115.	103.	5.9
1,2-Dichloroethane-d4	25. ng	10	71. to 83.	78.	4.2
1,1,1-Trichloroethane-d3	25. ng	10	78. to 96.	85.	6.6
Toluene-d8	25. ng	10	93. to 115.	101.	7.3
Nitrobenzene-d5	200. ug	9	29. to 90.	70.	36.
2-Fluorobiphenyl	200. ug	9	22. to 74.	50.	35.
Terphenyl-d14	200. ug	9	27. to 92.	60.	33.
Phenol-d3	80. ug	9	10. to 53.	41.	26.
Phenol-d5	400. ug	9	10. to 36.	20.	33.
2-Fluorophenol	400. ug	9	23. to 57.	43.	29.
2,4,6-Tribromophenol	400. ug	9	33. to 102.	70.	30.

a) Percent relative standard deviation of the spike recoveries.

Table 10

General Constituent Analyses Precision and Accuracy Report
Operating Industries, Los Angeles, CA
NEIC Project 024

		Method Triplicate Data			Field Triplicate Data			Spike Recovery Data			Control Sample Data		
Parameter	Units	Station	Average	%RSD	Station	Average	%RSD(a)	Spiked Sample	Spike Level	% REC(b)	Control ID	True Value	% DEV(c)
Alkalinity	meq/L	01-4	32.	1.1	Leach.	82.4	3.4				EPA-002	0.43	-7.0
F. Cyanide	ug/L CN	01-4	30.	7.0	Leach.	10.	50.	LTC	100.	92.2			
T. Cyanide	ug/L CN	01-4	122.	3.1	Leach.	30.	26.	01-4	100.	90.	EPA-179	370.	-1.8
Bromide	mg/L	W-13	20.	1.6	Leach.	47.	5.4	W-13	15.	107.			
Chloride	mg/L	W-13	2,700.	1.4	Leach.	6,300.	6.9	W-13	5,000.	109.	EPA-001	89.	-0.3
Fluoride	mg/L	LTA	1.06	5.0	Leach.	0.97	9.3	LTA	1.0	90.7	EPA-001	1.3	-1.5
Ammonia	mg/L N	LTA	993.	0.5	Leach.	927.	9.6	01-7	50.	90.	EPA-204	1.9	-2.1
Nitrate	mg/L N	W-13	ND		Leach.	ND		W-13	1.1	91.4	EPA-204	1.6	-2.0
Nitrite	mg/L N	W-13	ND		Leach.	ND		W-13	1.5	95.3			
Phosphate	mg/L P	W-13	ND		Leach.	5.3	9.4	W-13	1.7	90.2			
Phosphorus	mg/L P.	01-7	ND		Leach.	6.0	5.3	01-7	5.0	91.5	EPA-002	4.2	9.5
Sulfate	mg/L S	W-13	73.3	1.6	Leach.	2.0	5.3	W-13	66.7	95.3	EPA-001	31.3	-0.6
Sulfur	mg/L S	01-7	111.	1.1	Leach.	55.7	2.6	01-7	100.	99.0	EPA-002	2.4	3.0

a) Percent relative standard deviation.
b) Percent recovery of the spike.
c) Percent deviation of the found value from the true value.

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Table 11

Elemental Constituent Analyses Precision Report
Operating Industries, Los Angeles, CA
NEIC Project 824

	Method Triplicate Data						Field Triplicate Data					
	Dissolved Analysis			Total Analysis			Dissolved Analysis			Total Analysis		
Elmt	Station	Ave., ug/L	% RSD	Station	Ave., ug/L	% RSD	Station	Ave., ug/L	% RSD	Station	Ave., ug/L	% RSD (a)
Al	W-13	ND		W-13	ND		Leach.	369.	3.62	Leach.	546.	17.1
Sb	01-7	ND		W-13	ND		Leach.	ND		Leach.	ND	
As	01-7	ND		W-13	77.	5.7	Leach.	69.6	15.7	Leach.	71.4	0.56
Ba	W-13	415.	1.50	W-13	1,080.	1.69	Leach.	985.	1.0	Leach.	1,060.	2.50
Be	W-13	ND		W-13	ND		Leach.	ND		Leach.	ND	
B	W-13	9,630.	0.55				Leach.	15,400.	5.12			
Cd	W-13	ND		W-13	ND		Leach.	6.2	17.0	Leach.	4.5	20.3
Ca	W-13	425,000.	1.03	W-13	460,000.	1.09	Leach.	154,000.	3.5	Leach.	159,000.	1.01
Cr	W-13	ND		W-13	11.5	16.5	Leach.	94.9	5.1	Leach.	111.	3.64
Co	W-13	19.6	17.2	W-13	24.1	16.1	Leach.	52.3	3.94	Leach.	40.	
Cu	W-13	ND		W-13	65.7	3.77	Leach.	4.5	21.	Leach.	7.4	12.3
Fe	W-13	16,000.	1.47	W-13	29,400.	0.37	Leach.	14,300.	7.75	Leach.	16,000.	4.0
Pb	01-7	3.6	5.7	W-13	14.	2.2	Leach.	14.	1.25	Leach.	10.	33.0
Mg	W-13	210,000.	0.40	W-13	305,000.	1.53	Leach.	320,000.	1.25	Leach.	330,000.	1.67
Mn	W-13	11,000.	1.47	W-13	13,900.	0.7	Leach.	1,100.	5.92	Leach.	1,300.	0.42
Hg				01-4	ND					Leach	ND	
Mo	W-13	ND		W-13	ND		Leach.	ND		Leach.	ND	
Ni	W-13	40.3	0.77	W-13	41.1	9.99	Leach.	330.	1.47	Leach.	330.	2.61
K	W-13	7,420.	1.06	W-13	7,420.	2.02	Leach.	676,000.	2.04	Leach.	697,000.	2.34
Sc	W-13	ND		W-13	ND		Leach.	ND		Leach.	ND	
Se	01-7	ND		W-13	ND		Leach.	ND		Leach.	ND	
Si	W-13	20,900.	0.30				Leach.	10,300.	6.17			
Ag	W-13	ND		W-13	ND		Leach.	ND		Leach.	ND	
Na	W-13	1,120,000.	1.66	W-13	1,130,000.	2.67	Leach.	3,120,000.	0.90	Leach.	3,400,000.	3.95
Sr	W-13	3,840.	0.81	W-13	4,650.	0.7	Leach.	2,290.	1.44	Leach.	2,390.	2.3
Tl	01-7	ND		W-13	ND		Leach.	ND		Leach.	ND	
Ti	W-13	19.8	4.69	W-13	30.9	6.00	Leach.	54.2	4.19	Leach.	82.3	10.1
U	01-4	60.7	2.1				Leach.	ND				
V	W-13	41.1	1.40	W-13	66.9	2.00	Leach.	73.7	13.0	Leach.	105.	6.25
Y	W-13	ND		W-13	ND		Leach.	ND		Leach.	ND	
Zn	W-13	72.5	0.40	W-13	170.	3.9	Leach.	77.7	7.16	Leach.	107.	24.

a) Percent relative standard deviation.

Table 12

Elemental Constituent Analyses Accuracy Report
Operating Industries, Los Angeles, CA
NEIC Project 824

	Spiked Sample Recovery Data						Control Sample Data					
	Dissolved Analysis			Total Analysis			Dissolved Analysis			Total Analysis		
Elmt	Spiked Sample	Spike Level, ug/L	% REC	Spiked Sample	Spike Level, ug/L	% REC (a)	Control ID	True Value, ug/L	% DEV	Control ID	True Value, ug/L	% DEV (b)
Al	01-4	2,000.	105.	01-4	5,000.	103.	EPA-1	10,000.	-6.8	EPA-4	730.	30.0
Sb	01-7	200.	95.6	01-4	200.	105.	EPA-2	46.	-0.4			
As	01-7	200.	94.4	01-4	200.	107.	EPA-2	127.	-4.4	EPA-5	235.	-3.0
Ba	01-4	200.	101.	01-4	500.	103.	EPA-1	1,000.	-5.4			
Be	01-4	200.	90.6	01-4	500.	107.	EPA-1	1,000.	-1.8	EPA-4	235.	10.2
B	01-4	5,000.	90.3				EPA-1	1,000.	14.1			
Cd	01-4	200.	103.	01-4	500.	103.	EPA-1	1,000.	1.1	EPA-4	39.	16.9
Ca	01-4	250,000.	105.	01-4	250,000.	107.	EPA-3	40,600.	7.6	EPA-3	40,600.	8.5
Cr	01-4	200.	102.	01-4	500.	102.	EPA-1	1,000.	-10.	EPA-4	261.	-5.5
Co	01-4	200.	105.	01-4	500.	109.	EPA-1	1,000.	-6.3	EPA-4	261.	-1.7
Cu	01-4	200.	104.	01-4	500.	110.	EPA-1	1,000.	2.2	EPA-4	339.	-1.6
I	01-4	2,500.	92.									
Fe	01-4	2,000.	90.	01-4	5,000.	92.6	EPA-1	10,000.	-0.9	EPA-4	796.	9.7
Pb	01-4	10.	91.3	01-4	500.	105.	EPA-1	1,000.	-6.1	EPA-4	196.	9.2
Li	01-4	5.	90.									
Mg	01-4	250,000.	106.	01-4	250,000.	100.	EPA-3	8,400.	0.2	EPA-3	8,400.	3.4
Mn	01-4	2,000.	104.	01-4	500.	91.6	EPA-1	1,000.	-4.5	EPA-4	348.	-2.6
Hg				01-4	2.	81.7				EPA-6	4.	-5.6
Mo	01-4	200.	101.	01-4	500.	105.	EPA-1	1,000.	4.3			
Ni	01-4	200.	96.5	01-4	500.	110.	EPA-1	1,000.	-5.2	EPA-4	207.	-12.1
K	01-4	250,000.	95.8	01-4	150,000.	100.	EPA-3	9,000.	-2.9	EPA-3	9,000.	6.6
Sc	01-4	200.	99.2	01-4	500.	96.2						
Se	01-7	200.	92.2	01-4	200.	99.2	EPA-2	107.	-1.4	EPA-5	50.	1.0
Si	01-4	5,000.	100.									
Ag	01-4	200.	103.	01-4	500.	104.						
Na	01-4	2,500,000.	96.4	01-4	1,050,000.	100.	EPA-3	46,500.	7.5	EPA-3	46,500.	9.5
Sr	01-4	5,000.	94.	01-4	3,000.	100.	EPA-1	1,000.	-6.1			
Tl	01-4	10.	94.	01-4	500.	107.	EPA-1	1,000.	-9.6	EPA-4	100.	7.4
Ti	01-4	200.	102.	01-4	500.	92.8	EPA-1	1,000.	-2.3			
W	01-4	50.	98.2									
V	01-4	200.	99.8	01-4	500.	106.	EPA-1	1,000.	-0.4	EPA-4	846.	5.4
Y	01-4	200.	99.4	01-4	500.	94.8						
Zn	01-4	200.	105.	01-4	500.	105.	EPA-1	1,000.	-5.9	EPA-4	418.	5.8

a) Percent recovery of the spike.
b) Percent deviation of the found value from the true value.

APPENDIX D

ON-SITE TREATMENT PLANT CONFIGURATION - ALTERNATIVE 4

APPENDIX D

ON-SITE TREATMENT PLANT CONFIGURATION - Alternative 5

The treatment plant configuration for Alternative 5 consists of raw leachate collection and pumping system, raw leachate storage tanks, oil and grease separator, conditioning tank, dissolved air flotation (DAF) system, gravity sand filters, air stripping tower, activated carbon filters, effluent storage tanks and effluent pumping equipment (reference to the process schematic and general layout, Figure 4.1 and 4.2). In addition, the plant is configured with an oil and grease storage tank, sludge thickening centrifuge or belt-filter press equipment, sludge storage tank and vapor phase carbon adsorption units for scrubbing of the exhaust air from the air stripping tower. The treatment plant will also need intermediate pumping equipment, chemical feed equipment and a laboratory/operation building.

Preliminary sizing of each component is based on a nominal flow rate of 30 gpm. The operational range of the plant is 15 gpm to 35 gpm. The dimensions given in the following sections are for the purpose of determining the size of site required to construct a 30 gpm plant. Provisions were made in the siting requirements for expansion up to a 120 gpm plant. The space required for a 120 gpm facility is approximately 60,000 ft^2.

The discussions presented as follows are in the sequence that treatment would occur within the plant.

- Leachate Storage Tanks

  Two double-wall steel tanks or single wall types with field installed containment. Total tank volume is 100,000 gallons ±. Approximate dimensions of each tank is 24' Ø x 15' in height.

It is estimated that the tanks will have up to ten days of storage capacity that can be utilized in the event the treatment plant has to be shut down for a period of time.

- Oil and Grease Separator

  Prepackaged unit either corrugated metal plate or vertical tube coalescing separator. Approximate dimensions = 6'L x 3' W x 5' H (675 gallons). Retention time is approximately 20 minutes. The appropriate retention time and sizing of the units will be more accurately determined in the pre-design study for the facility. Two side streams are produced from this unit, grease and oil will be skimmed off to a storage tank, and the settled grit and silt will be pumped to a sludge holding tank. (This holding tank will store the sludge from the DAF unit as well.) The unit can be expected to reduce oil content to 10 mg/l and to remove oil globules down to 20 the micron size (cited from manufacturer's literature for a VTC separator).

- Conditioning Tank

  This tank provides coagulation and chemical addition to the degreased leachate flow. The retention time is relatively short, up to 60 seconds. The tank will be provided with a mechanical mixer and chemical feeding inlets. Alum will be used as a primary coagulant and polymer as a coagulant aid. These chemicals will be added in dosages proportional to the flow into the conditioning tank. Preliminary results from the treatability study jar tests (Appendix E) indicate that an alum dosage of 50 mg/l is very effective in coagulating the leachate which may contain some quantities of oil and grease that escapes the oil and grease separator unit. The tank capacity is approximately 55 gallons.

- DAF Unit

The DAF unit consists of an air dissolution tank, a floatation tank and related appurtenances such as an air compressor system and a recirculation pump. Air is dissolved into the chemically treated and coagulated wastewater in the dissolution tank before the flow passes through the flotation tank where under the atmospheric pressure, dissolved air is released to form small air bubbles which adhere to the floc particles causing them to rise to the surface. Some settling will also occur in the flotation tank, hence, the DAF unit produces two side streams, skimmings and sludges which will be pumped to the sludge holding tank.

The entire unit and accessories can be shop-fabricated on a skid for simple field installation. Approximate dimensions for the flotation tank are 8' Ø x 10' H (3,750 gallons) and for the air dissolution tank (or retention tank) 2'Ø x 6' H (140 gallons). Because of the variability of the structure and surface properties of the floc particles, laboratory and pilot testing will be required to determine design criteria such as hydraulic and solids loadings and appropriate detention times.

The size specified above would provide approximately 120 minutes residence time in the flotation tank.

- Gravity Sand Filters

The clarified effluent from the DAF unit is passed through a layer of sand with 0.9 to 1.2 mm effective size. The sand layer is generally two feet deep. Any solids present in the clarified wastewater will be captured in the sand layer. The design filtering rate is 3 gpm/sq. ft., resulting in a minimum surface area of 10 square feet (5 ft^2/filter). Two filters will be provided. Backwash pumps and control piping valving will be required. Backwash will be pumped to the leachate tanks for treatment. Approximate overall dimensions for each filter are 4'W x 4'L and 7'H.

- Air Stripping Tower

Air stripping system is provided to remove volatile organics from the effluent of the gravity sand filters. Flow will be recirculated through the tower which has a plastic packing media, for a period of time to produce the needed degree of removal. The air stripping process will reduce the O&M costs associated with the activated carbon filters located downstream by reducing the organic loading. The exhaust air from the air stripping tower contains volatile organics such as benzene, ethylbenzen, toluene, etc. In order to meet the air quality standards, a vapor phase carbon adsorption unit will be used to scrub the exhaust air. Vapor phase carbon adsorption is more efficient than the liquid phase adsorption in the GAC units. Air flow can be sized based on 13.4 scfm per 1 gpm of wastewater flow (cited from manufacturer's literature). This will result in a minimum air supply of 400 scfm. Packed tower and accessories can be prepackaged and skid mounted for ease of field installation. Approximate overall dimensions are 10'W x 12'L x 23'H.

- Activated Carbon Filters

Non-volatile and escaping volatile organic matter from air stripping effluent are removed by adsorption in the activated carbon filters. The system is comprised of two carbon filter vessels (72 cubic feet per vessel), a carbon transfer tank and associated carbon transfer equipment. The filters may be operated in parallel or in series.

Spent carbon from the filters is transported to the transfer tank for temporary storage. After the filter vessel is filled with fresh carbon delivered by a tank truck, the spent carbon is transported to the tank truck for regeneration or disposal by the activated carbon supplier. It is estimated that the carbon filters will need replenishing every two to three months (cited from manufacturer's estimate). Overall dimensions are 15'L x 10'W x 12'H.

- Effluent Storage Tanks

Three storage tanks will be provided. Each tank has 43,000 gallons of capacity (3 days of treatment plant effluent). Approximate dimensions of each tank are 21' dia. x 16.5' high. One tank will be on-line receiving treated leachate. A second tank will be emptying treated effluent to the sewer. The third tank's content will be undergoing testing for adherence to the effluent discharge limitations. The tanks will be interconnected to the leachate storage tanks for the purpose of re-treating the effluent if it does pass batch test for sewering.

- Sludge Dewatering Equipment

A centrifuge will be used for dewatering the settled solids from the oil and grease separator and the sludge from the DAF unit. The quantity of sludge produced from the processes is estimated to be less than 0.5% by volume (as estimated from suspended solids content of the leachate) of the treated leachate. A centrifuge 10"-12" bowl diameter should be adequate for the dewatering purposes. Overall dimensions are 4'W x 6'L x 6' H.

Dewatered sludge, if hazardous, will be disposed of at an RCRA landfill. The sludge will require testing to determine its chemical make up.

APPENDIX E

OII LEACHATE JAR TESTS

APPENDIX E

OII LEACHATE JAR TESTS

Jar tests were conducted on July 17 and 18 at CDM-Boston laboratory, on a liquid leachate sample which was received on July 16, from the site of Operating Industries Landfill at Monterey Park, California. The description of the bench scale experiment, purpose, and result of each jar test run is described in the following discussion:

Jar Test No. 1

Purpose: This test investigated the effect of raising pH to 9.2

Experiment: pH of raw leachate was increased to 9.2 by adding a lime dosage of 120 mg/l

Mixing: 1 minute at 100 rpm
10 minutes at 20 rpm

Settling: 20 minutes

Observation: More oil and grease emulsified, and the separation of oil and grease by skimming became more difficult.

Result: Raising the pH of leachate, by adding lime or caustic dosages, should be avoided, since at pH of 9.2 more oil emulsified, and decreased the efficiency of separating oil and grease from raw leachate by skimming.

Jar Tests Nos. 2 and 3

Purpose: These two tests investigated effectiveness of using ferric chloride as coagulant. In Jar Test No. 2, a ferric chloride dosage of 20 mg/l was added to leachate, which in Jar Test No. 3, the ferric chloride dosage was 50 mg/l.

Experiment: Mixing 1 minute at 100 rpm
10 minutes at 20 rpm
Settling 20 minutes

Observation: Small particles of floc started to form after 5 minutes of slow mixing at 20 rpm. None of the floc particles settled down, after allowing 20 minutes of settling period.

Result: Dosages of ferric chloride between 20-50 mg/l were not effective in treating the raw leachate as primary coagulant.

Jar Tests Nos 4 and 5

Purpose:	These two tests investigated effectiveness of using alum solution as coagulant. In Jar Test No. 4, an alum dosage of 20 mg/l was added to raw leachate, while in Jar Test No. 5, the alum dosage added was 50 mg/l.
Experiment:	Mixing 1 minute at 100 rpm 10 minutes at 20 rpm Settling 20 minutes
Observation:	During the first minute of slow mixing at 20 rpm, visible floc particles started to form and grow in size. The size of floc particle resulting from treating with higher alum dosage (50 mg/l) was much larger in size than the floc particles resulting from treating with lower alum dosage (20 mg/l). During the settling period of 20 minutes, the floc particles, whether it was small in size in Jar Test No. 4, or the larger size in Jar Test No. 5, were floating to the top and leaving a clear but dark yellowish colored solution. After skimming the top of the Jar Test No. 5, the treated leachate was filtered easily through a coarse qualitative filter paper. A sample from the filtered leachate treated with 50 mg/l is kept (in sample bottle no. 1) for analysis, if more information about the treatment up to this stage is required.
Result:	Test results indicated that an alum dosage of 50 mg/l, when mixed, is very effective to coagulate the raw leachate. The fact that the formed floc particles, whether small or large in size, tends to float to the top and not settle down in the bottom of the jar, indicates that an air flotation unit and not a solid contact clarifier is required in the process flow. Observation obtained from Jar Test No. 5 was that the oil and grease that escapes from the oil separator unit, in addition to the emulsified oil in the leachate can be effectively treated when mixed with 50 mg/l alum dosage. When such treated leachate is allowed to pass through a well selected air flotation unit, the skimmings will be separated, leaving an easily filterable treated leachate. At this stage, the emulsified oil in addition to metals should be separated. The filtered treated leachate should be further treated for removing the volatile and non-volatile organic matter.

Jar Test No. 6

Purpose: This test investigated the effectiveness of treating one liter of the filtered treated leachate (with 50 mg/l alum dosage) obtained from Jar Test No. 5, with five grams of activated granular carbon.

Experiment:

1) Jar Test No. 6 contained one liter obtained from filtering the treated leachate in Jar No. 5.
2) 5 grams of granular activated carbon added.
3) Mixing for 10 minutes at 10 rpm
4) Settling 10 minutes
5) Solution decanted and kept in sample bottle No. 2 for analysis.

Observation: Once the filtered treated leachate was in contact with the granular activated carbon particles, the dark yellowish color caused by organics started to fade, leaving a yellow clear colored solution, which was decanted easily.

Result: Carbon adsorption is required to remove the volatile and non-volatile organic matter.

If the analytical results of the sample collected from the treatment of raw leachate with 50 mg/l alum, filtered, and then treated with 5 grams per liter activated carbon for a contact period of 10 minutes, conforms with the discharge limitations, this will conclude the purpose of the treatability studies conducted to indicate type of chemicals, concentration of dosages, and flow process optimization.

APPENDIX F

REMEDIAL ACTION ALTERNATIVE COST ESTIMATES

APPENDIX F

REMEDIAL ACTION ALTERNATIVE COST ESTIMATES

Alternative 1

Off-site treatment and sewering (ChemTech treatment plant)

- Annual Cost

The annual cost is based upon the trucking and treatment of 3,744,000 gallons of leachate (equivalent to 30 gpm plant operating 40 hours per week). Unit costs of $.30/gallon for treatment, $.03/gallon for trucking and $1,800/month for storage tank rental were used to develop the annual cost as follows:

1.	Treatment cost	= $0.30 x 3,744,000	=	$ 1,123,200
2.	Trucking cost	= $0.03 x 3,744,000	=	112,320
3.	Storage tank rental	= $1,800 x 12	=	21,600
		Subtotal		1,257,120
4.	Administrative costs	@ 3%	=	37,710
5.	Contingencies @ 25%		=	314,280
		Total		$ 1,609,110

- Capital Cost

The only capital cost associated with the off-site treatment is the construction of a spill containment area around the storage tanks. The spill containment would be sized to hold the contents of two tanks (40,000 gallons). Estimated cost is:

1.	Site preparation and access	=	$ 6,000
2.	Concrete 40 cubic yards @ $300/cy	=	12,000
	Subtotal		18,200
3.	Contractor's overhead and profit @ 15%	=	$ 2,700
4.	Contingency @ 25%	=	4,550
5.	Engineering, administration and legal @ 25%	=	4,550
	Total		$ 30,000

Alternative 5

- Capital cost of a new leachate pre-treatment plant, consisting of gravity separation, chemical addition, DAF, filtration, air stripping with vapor phase carbon adsorption, liquid phase carbon adsorption located at one of the four sites discussed in Section 4.

The following components of the treatment plant will have the same cost for all of the alternative site locations discussed in Appendix G:

Item	Cost
Leachate pump station (5 hp)	$ 15,000
Leachate double walled storage tanks (2 @ 50 K gallons each)	90,500
Oil and grease separator (50 gpm capacity)	11,400
Conditioning tank with mixer (50 gallon)	3,000
Chemical feed system	5,100
Dissolved air flotation system (50 gpm capacity)	54,000
Gravity sand filters (2 at 57 gpm each)	45,000
Air stripper (60 gpm capacity)	14,500
Carbon adsorption, vapor phase	45,500
Activated carbon filters (2 at 72 ft^3 each)	69,000
Sludge thickening equipment (centrifuge)	61,500
Effluent double walled storage tanks (3 @ 43,000 gallons each)	114,200
Effluent pumping station (5 hp)	15,000
Intermediate lift stations (3 @ 3 hp each)	36,000

Item	Cost
Instrumentation & electrical equipment (central control, alarms, sensors, service connections, etc.)	50,000
Laboratory facility and equipment (including standby generator)	140,000
Sewer connection fee	40,000
Miscellaneous equipment (chemical storage, sludge tanks, etc.)	20,000
Treatment Plant Cost	$829,700

Note: The cost quotes for the various process components include normal field installation and hook-up.

Capital cost analysis for different locations of the treatment facility:

A. Location, south parcel:

Treatment facility	$829,700
Influent force main, 4" @ 2,000'	40,000
Effluent force main, 4" @ 2,500'	50,000
Water main, 200'	2,000
Access road 200' x 24' wide	16,800
Site preparation	20,000
Architecture, landscaping, and block wall (including noise abatement)	135,000
Subtotal	$1,093,500
Contractor's Overhead & Profit @ 15%	164,025
Contingency 25%	273,375
Engineering, Administration and Legal @ 25%	273,375
Total	$1,804,275

Item	Cost
B. Location, parcel north of Pomona Freeway:	
Treatment facility	$ 829,700
Influent force main, 4" @ 4,000' (underneath freeway)	145,700
Effluent force main, 4" @ 2,000'	40,000
Water main 1000	10,000
Access road, 200' x 24' wide	16,800
Site preparation	20,000
Architecture, landscaping and block wall	135,000
Subtotal	$1,197,200
Contractor's Overhead & Profit @ 15%	179,580
Contingency @ 25%	299,300
Engineering, Administration and Legal @ 25%	299,300
Total	$1,975,380

Item	Cost
C. Location, adjacent to eastern boundary on Chevron Corporation land in Montebello:	
Treatment facility	$ 829,700
Land cost (60,000 ft^2)	125,000
Influent force main, 3,500'	70,000
Effluent force main, 1,600'	32,000
Access road 400' x 24' wide	33,600
Water main, 1,000'	10,000
Site preparation	25,000
Architecture, landscaping and block wall	135,000
Subtotal	$1,260,300
Contractor's Overhead & Profit @ 15%	189,045
Contingency @ 25%	315,075
Engineering, Administration and Legal @ 25%	315,075
Total	$2,079,495

Item	Cost
D. Location, on top of the landfill:	
Treatment facility	$ 829,700
Influent force main 1,500'	30,000
Effluent gravity pipeline, 2,400	36,000
Access road 1,000' x 24' wide	84,000
Water main 1,200'	12,000
Site and foundation preparation	125,000
Subtotal	$1,116,700

Item	Cost
Contractor's Overhead & Profit @ 15%	167,505
Contingency @ 25%	279,175
Engineering, Administration and Legal @ 25%	279,175
Total	$1,842,555

- Operation and maintenance (annual) costs for Alternative 5 are shown below. It is assumed that the only variable cost between the different locations will be the power costs associated with pumping the influent and/or effluent and the adjustments for differential settling projected with location D. It is also assumed that the operation of the plant and lab will be contracted.

	Item	Costs			
		Loca. A	Loca. B	Loca. C	Loca. D
1.	Labor 2080 MH x $184.80/hr	$384,400	$384,400	$384,400	$384,400
2.	Maintenance 12 months x $1,000	12,000	12,000	12,000	20,000
3.	Power 80 kw (2080 hours/year) ($0.06/kw)	12,000	16,000	16,000	10,000
4.	Sludge disposal (80% S.S. removal) (35 gal/day) (265 days/year) ($1.60/gallon)	15,000	15,000	15,000	15,000
5.	Chemicals Alum (15 lbs/day) Polyelectrolytes Activated Carbon (118,000 lb x $1.00/lb) Sodium Hexametaphosphate (1 drum/month)	125,000	125,000	125,000	125,000
6.	Sewering surcharge (COD & SS)	12,000	12,000	12,000	12,000
	Subtotal	$560,400	$564,400	$564,400	$566,400
7.	Contingency @ 25%	140,100	141,100	141,100	141,600
	Total	$700,500	$705,500	$705,500	$708,000

Alternative 2

- Capital cost of a new on-site leachate treatment facility consisting of the same process train as Alternative 5 except for removal of the liquid phase carbon adsorption columns.

Item	Cost
Alternative 5 treatment plant (Location B)	$1,975,380
Delete liquid phase GAC	<113,850>
Total (including overhead, profit, contingency, engineering & admin.)	$1,861,530

- Operation and maintenance (annual) costs for Alternative 2:

Item	Cost
Alternative 5 (Location B)	$ 705,500
less carbon replacement cost	<147,500>
Total (including overhead, profit, contingency, engineering & admin.)	$ 558,000

Alternative 3

- Capital cost of a new on-site leachate treatment facility consisting of the same process train as Alternative 5, except for the removal of the air stripping tower.

Item	Cost
Alternative 5 (location B) treatment plant	$1,975,380
Delete air stripping tower	< 99,000>
Total (including overhead, profit, contingency, engineering & admin.)	$1,876,380

- Annual costs for Alternative 3:

Item	Cost
Alternative 5	$ 705,500
Additional carbon usage (60,000 lbs)	75,000
Total (including overhead, profit, contingency, engineering & admin.)	$ 780,500

Alternative 6

- o Capital cost of a new on-site treatment facility consisting of the same process train as Alternative 5 with the addition of reverse osmosis/ ultrafiltration.

Item	Cost
Alternative 5 treatment plant (Loc. B)	$1,975,380
Ultrafiltration/reverse osmosis system	321,800
Total (including overhead, profit, contingency, engineering & admin.)	$2,297,180

- o Annual costs for Alternative 5:

Item	Cost
Alternative 5	$ 705,500
Power, maintenance, replacement membranes required for UF/RO system	37,500
Total (including overhead, contingency & admin.)	$ 743,000*

* Credit for irrigation water savings not included.

APPENDIX G

SITING CONSIDERATION AND COST ANALYSIS OF THE ON-SITE TREATMENT FACILITY

APPENDIX G

SITING CONSIDERATION AND COST ANALYSIS OF THE ON-SITE TREATMENT FACILITY

In considering the construction of a new treatment plant at the OII landfill site, four possible locations were identified[1]. The approximate locations and direction and distance to points of sewering are shown in Figure G-1. Location A is on the south parcel on a level area south of the existing GSF facility and flare station. Trash was never disposed of in this area. Location B is on the parcel north of the Pomona Freeway and adjacent to the area where waste was disposed of in the early days of the landfill operation. Location C is on land owned by Chevron Corporation abutting to the eastern boundary of the landfill site and in the city of Montebello. Location D is on the top of the landfill. The locations shown in Figure G-1 are approximate, pending further site investigation. It is estimated that a site area of approximately 60,000 ft^2 would be required to provide the space for a 30 gpm with room for expansion to a 120 gpm facility. In estimating the size requirements the following were considered:

- Space for unit processes and influent and effluent storage for a 120 gpm facility.
- Space for sludge handling
- Provision for a clean area for the laboratory and office and unloading of chemicals.
- A decontamination area and area for washing down trucks leaving the sludge handling area.

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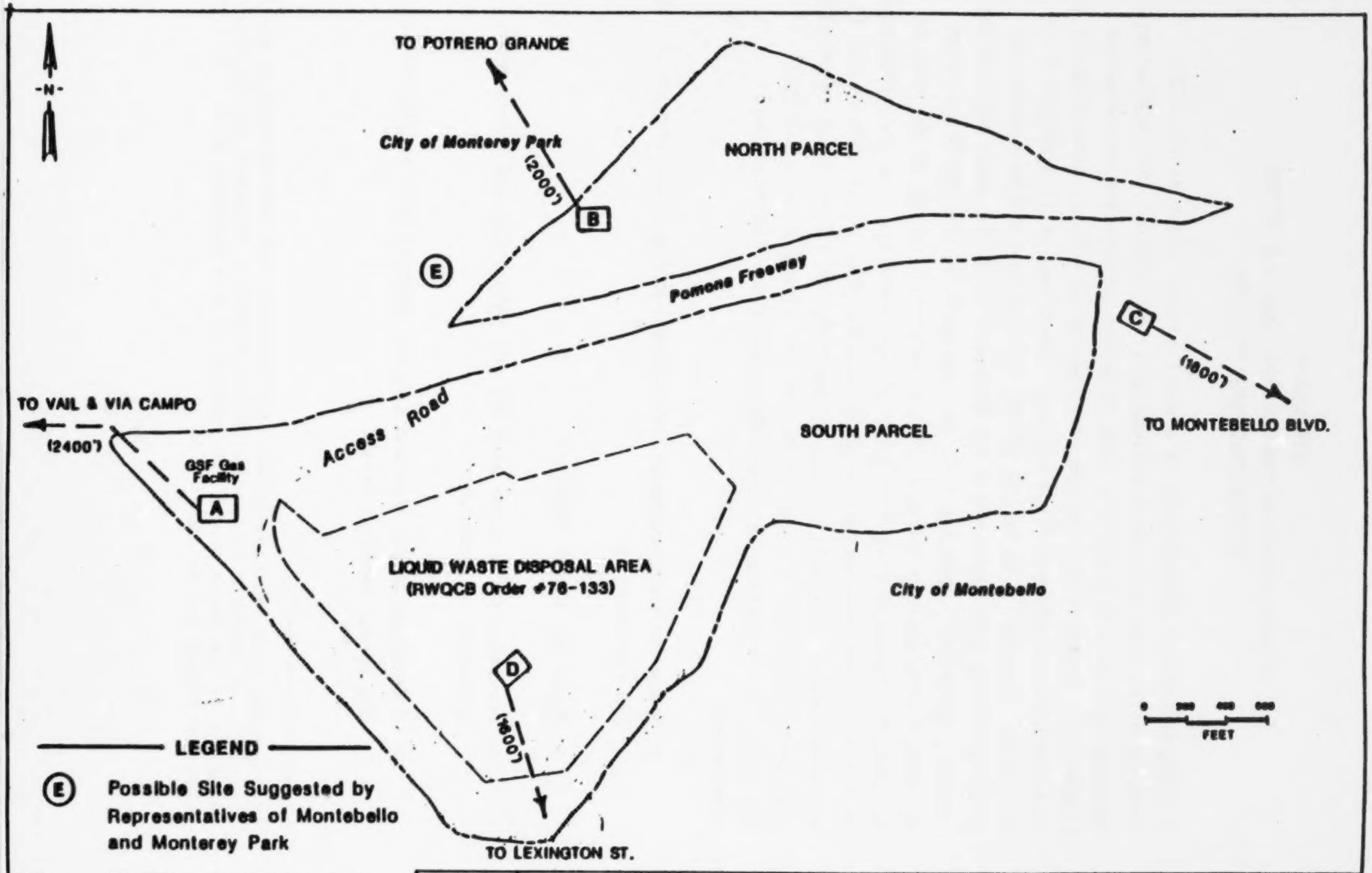
[1] In meetings with representatives from Monterey Park and Montebello another location, on Southern California Edison property, adjacent to the western boundary of the north parcel was identified as a possible site. This is shown on Figure G-1 as location E.


-N-
TO POTRERO GRANDE
City of Monterey Park
(2000')
B
NORTH PARCEL
E
Pomona Freeway
C
(1800')
TO MONTEBELLO BLVD.
TO VAIL & VIA CAMPO
(2400')
Access Road
GSF Gas Facility
A
SOUTH PARCEL
LIQUID WASTE DISPOSAL AREA
(RWQCB Order #76-133)
City of Montebello
D
(1800')
TO LEXINGTON ST.
0
FEET

LEGEND

Ⓔ Possible Site Suggested by Representatives of Montebello and Monterey Park

← — (2400') Direction of Sewering and Approximate Distance to Point of Sewering

Project No.	Oil Industries Landfill	ON-SITE TREATMENT FACILITY ALTERNATIVE LOCATIONS	Figure
120-RI2	Camp Dresser & McKee Inc.		G-1

The treatment plant processes and unit sizes are the same for all locations and are based upon pretreatment and air stripping with off-gas treatment followed by activated carbon. The main differences affecting costs between the different locations are the length of leachate and effluent piping involved, the site acquisition, and site access and preparation work.

Site Location Considerations

Location A:

- Close to the area of the landfill where liquid wastes were disposed and to the leachate collection tanks.
- Site is on undisturbed land, i.e., not a part of the garbage disposal area. Furthermore, the site is relatively flat and easily accessible from the Greenwood Avenue extension.
- Site is within a few hundred feet of residences in the City of Montebello. Residents are concerned with the proximity of this site location. Major concerns are noise, odors, and safety. The elevation of the site is approximately 50 feet lower than the adjacent homes so the treatment facility would not be in a direct line of sight. However, noise and odor abatement devices would be required in order to minimize impacts on the adjacent residents.

Location B:

- This location is a flat site located several thousand feet from residential neighborhoods. It is buffered from residential areas by the Pomona Freeway to the south and the Southern California Edison easement property to the north.
- Facility will require approximately 1.4 acres out of the 45-acre North Parcel. This would allow for potential future business development by the City of Monterey Park on property remaining after the final remedy is completed.
- Leachate may be piped across or underneath the Pomona Freeway in accordance with Caltrans regulations and requirements.
- The site is located within the OII Superfund site boundaries, and would therefore require no acquisition of property, access, or permit.

Location C:

- Would require the acquisition of approximately 1.4 acres of land from the Chevron Corporation (not including access road).

- Site would be located 3500' to 4000' from the leachate collection tanks. Leachate line to the plant site would be located close to the yards of numerous residences in the City of Montebello.

- Site could be located such that the treatment facility would not be visible from the neighboring residential areas.

- City of Montebello is developing plans to acquire this property from Chevron and use it for an Auto Center and light commercial activities.

Location D:

- Site on top of the landfill would close to the leachate collection tanks.

- Could gravity feed treatment plant effluent to the sewer system thereby reducing pumping costs.

- Would require a special geotechnical study to determine a suitable location for the unit processes and storage tanks.

- Special design considerations would be required to accommodate anticipated differential settling. The locations and magnitude of settling is not predictable and could cause serious problem in maintaining the integrity of the facility.

- Location may not be compatible with the final remedy for the site. Siting would need to be coordinated with gas monitoring and extraction well locations, as well as site grading and capping plans.

- Overall, siting at Location D would probably delay the implementation of the treatment facility and add costs to the final remedial action process.

The comparison of costs and the present worth costs for discount rates of 6% and 8% for operational periods of five years and thirty years is presented in Table G-1. Capital and annual costs computations are contained in Appendix F. As shown in the table, there is little difference from the standpoint of cost between the various site locations, e.g., 6.5% difference between location C (highest) and Location A (lowest) for the five-year period at 6% interest.

A cost analysis was not performed for siting a facility at location E. The alternative is similar to that of location B but has an additional cost of land acquisition.

TABLE G-1

PRESENT WORTH ANALYSIS FOR SITING TREATMENT FACILITY

ALTERNATIVE 5

ITEM	LOCATION A	 B	 C	 D
Est. Annual O&M	$700,500	$705,500	$705,500	$708,000
Est. Capital Cost				
for 5 yr.	$1,804,275	$1,975,380	$2,079,495	$1,842,555
@6% for 30 yr.	$2,184,197	$2,355,302	$2,459,417	$2,222,477
@8% for 30 yr.	$2,086,031	$2,257,136	$2,361,251	$2,124,311
O&M Present Worth				
@6% for 5 yr.	$2,950,506	$2,971,566	$2,971,566	$2,982,096
@8% for 5 yr.	$2,797,097	$2,817,062	$2,817,062	$2,827,044
@6% for 30 yr.	$9,642,383	$9,711,208	$9,711,208	$9,745,620
@8% for 30 yr.	$7,886,229	$7,942,519	$7,942,519	$7,970,664
Present Worth (Capital + O&M)				
@6% for 5 yr.	$4,754,781	$4,946,946	$5,051,061	$4,824,651
@8% for 5 yr.	$4,601,372	$4,792,442	$4,896,557	$4,669,599
@6% for 30 yr.	$11,826,580	$12,066,510	$12,170,625	$11,968,097
@8% for 30 yr.	$9,972,260	$10,199,655	$10,303,770	$10,094,975

Present Worth Ranking

1 - Location A
2 - Location D
3 - Location B
4 - Location C

Site E was identified as another possible siting alternative based on meetings with representatives of Montebello and Monterey Park. A cost analysis was not performed for siting a facility at location E, however, these costs are anticipated to be similar to those for the other sites. Treated effluent from a plant at site E could be discharged to either Montebello sewers (Vail and Via Campo) or Monterey Park sewers (Potrero Grande).